AGRICULTURAL COLLEGE, HEBBAL

REPORTS SECTION

1946 - 1971

Silver Jubilee Souvenir

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ITY OF AGRICULTURAL SCIENCES
BANGALORE

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Agricultural College, Hebbal

1946 - 1971

SILVER JUBILEE SOUVENIR

UNIVERSITY OF AGRICULTURAL SCIENCES

HEBBAL - BANGALORE-24

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FOREWORD

Education has all along been considered as one of the crucial variables in achieving human progress through economic emancipation For, it pushes back traditional inhibitions; it broadens the scope for decision making since it expands capacity for comprehension of the natural phenomena. It motivates a person for greater achievements as he can think through the problems confronting him and not merely accept them as decrees of the gods that are beyond change. This is more particularly relevant in the case of the farmer: as education increases, his inquisitiveness might provoke self-discovery of new knowledge pertaining to his farm operations.

Some efforts at educating the farmer so as to improve his productivity have been made in various parts of the country right from the beginning of this century. The earliest places of agricultural educational activity in the then British India were Pusa, Poona, Coimbatore and Allahabad. These pioneer institutions in a modest way involved themselves in the farmers educational programmes comprising direct education of the farmers themselves in improved techniques of crop production and education of persons such as extension officers, agricultural specialists and agricultural teachers who directly served the farmers.

Among the princely states, Mysore has been in the vanguard of progress from the very beginning. The development of industries, electricity, education and public health facilities was at par or even better in some respects than in British India. Along with these, the State Government initiated education programmes in agriculture by starting an agricultural department at the close of the last century. Although the laboratories were located in the city, the venue for the experimental and teaching activities was Hebbal. In this Silver Jubilee Souvenir, an attempt has been made to portray these activities, with emphasis on what has happened in the last 25 years after the starting of the agricultural college. The Institution can rightly feel proud of its past achievements in the service of the Mysore Farmers and look forward with hope, being the centre of activities in the University of Agricultural Sciences, for ever expanding contribution to the emancipation of agriculture in the State.

K. C. NAIK
Vice-Chancellor

PREFACE

UNLIKE the traditional institutions of higher learning, largely involved in pursuit of intellectual activities in ivory towers away from the maddening crowd, the agricultural colleges are places where both students and teachers continuously think and learn about the various problems connected with the common rural people with the object of improving their condition. The success or otherwise of an agricultural institution is naturally judged on the basis of what it has done for the improvement of the farmers in the region in which it is located. The Silver Jubilee is an occasion for stock taking. We come to know what we have done and we could certainly take the legitimate share of our pride for achievements. Further, it would help us to know what has to be done. This kind of an exercise would provide a base for further work.

In order to achieve the above objective, articles reviewing the involvement of the various disciplines in teaching, research and extension activities in the past 25 years as also an article embodying the different phase of development of Hebbal as a Centre of Agricultural Education have been included. The authors of these articles are persons with a record of devoted work in the cause of the College in particular and agricultural improvement of the State in general.

The messages of good will we have received from those who were connected with the development of the institution at various stages is a great source of encouragement. Some of our old students look back on their college days with affection and pride. Their contributions to the *Souvenir* is an evidence of their continued interest in the institution.

It is our distinguished Vice-Chancellor who suggested that we should celebrate the Silver Jubilee of the College. He functioned as the Chairman of the Silver Jubilee Committee and provided continuous guidance in organisation of the function. Whatever success that we have been able to record, we owe it to him. The Dean, The Director of Instruction (Agrl.) and other officers of the University have afforded us valuable co-operation by serving as members of the various committees set up for organising the celebrations.

It is my privilege to acknowledge with gratitude the cooperation I received from these and several others in my work.

B. V. VENKATA RAO
Convenor
Silver Jubilee Committee

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Messages

The President is glad to know that the Silver Jubilee of the Mysore Agricultural College will be celebrated in April, 1972. He sends his congratulations and best wishes on the occasion.

RASHTRAPATI BHAVAN
NEW DELHI

A.M. ABDUL HAMID
Press Secretary to the President

The Prime Minister is glad to know that the Silver Jubilee of the Mysore Agricultural College is being celebrated in April this year. She sends her good wishes for the success of the function.

Prime Minister's Secretariat
New Delhi-11

Sd/-
H.Y. Sharada Prasad
(Director, Information)

I am glad to learn that the Mysore Agricultural College, a constituent of the University of Agricultural Sciences, Bangalore, is celebrating its Silver Jubilee in April 1972.

The College, started in 1946, gained importance after the advent of the University of Agricultural Sciences in 1965, and has been laying emphasis on the co-ordinated integration of the teaching, research and extension aspects of agricultural training. In the last 25 years, the College has endeavoured to contribute its best towards the improvement of agricultural practices in the State. It has sent out trained personnel to be in charge of the various developmental programmes. It is gratifying to note that the College has so far produced over 1500 agricultural graduates, who are working with distinction all over India. It is appropriate on this happy occasion to remember the great services of Dr. Lehmann and Dr. Leslie C. Coleman who laboured hard to initiate scientific agricultural education in the early years of this century in Mysore State.

I send my greetings and best wishes on this joyous occasion and wish the function all success.

MOHANLAL SUKHADIA
Governor of Mysore
and
Chancellor, University of Agricultural Sciences

RAJ BHAVAN
BANGALORE

I am very happy to learn that the Silver Jubilee of the Agricultural College, Hebbal, is being celebrated on April 8, 1972. It is an occasion to pause and look back on achievements. This would serve as an inspiration for more productive work in the years to come.

I know the Agricultural College at Hebbal has a high reputation as a pioneer in agricultural education and rural development. Now, as a focal point of activity of the University of Agricultural Sciences, I am confident that it will provide for the planned development of agriculture in all its aspects in the State of Mysore. I wish the function all success.

K. H. Patil

Minister for Agriculture and Forests
and
Pro-Chancellor
University of Agricultural Sciences
BANGALORE

VIDHANA SOUDHA
BANGALORE-1

I am happy to learn that the Mysore Agricultural College is celebrating its Silver Jubilee on April 8, 1972. I have been associated with the college and the University of Agricultural Sciences in various capacities over these 15 years. What is always fresh in my memory is the 6 years I spent at Hebbal first, as a student in the Agriculture School and later as a student of the Agricultural College between 1947 and 1953.

Ours used to be a small class and we got individual attention at the hands of our teachers both as students and as youngmen trying to understand human problems, particularly in relation to our rural economy. Needless to say, that what I learnt from them has been of immense help to me in my farming as well as in public work. I am grateful to the institution which shaped me for the work nearest to my heart viz. farming and public service. I am confident that the Agricultural College as an important constituent of the University of Agricultural Sciences will play an ever increasing role in the service of the State's Agriculture. I wish the Silver Jubilee Celebrations all success.

VIDHANA SOUDHA
BANGALORE-1

N. Chikke Gowda
Minister of State for
Animal Husbandry and Veterinary Services
Government of Mysore

I am very happy to know that the Publications Council of the University of Agricultural Sciences at Bangalore is bringing out a Souvenir on the occasion of the Silver Jubilee of the Mysore Agricultural College. There is no doubt that during this period of a quarter century, the Mysore Agricultural College has rendered useful service and has contributed substantially towards the prosperity of agriculture in the State of Mysore. I am confident that as a constituent college of the Agricultural University, it will have even greater opportunities to play its role more effectively in the future.

I send my best wishes on this occasion.

B. P. PAL

NEW DELHI

Retired Director-General, I.C.A.R.

I am very happy that the Mysore Agricultural College has completed 25 years of very useful service to the farmers of the State. Indian agriculture is now in a dynamic state of transition from its sole dependence on the vagaries of the weather to a growing application of science and technology. The agriculture of Mysore State offers great challenges to research workers, since much of the area is purely rainfed. I am confident that during the next 25 years, the Mysore Agricultural College will be able to convert the natural endowments of the State into wealth meaningful to the people.

M. S. SWAMINATHAN

Director-General, I.C.A.R., and Secretary to Government of India, Ministry of Agriculture

NEW DELHI

I am happy that the Mysore Agricultural College in Bangalore is celebrating its Silver Jubilee after serving the interests of the agriculturist effectively and efficiently for the last 25 years. They deserve our congratulations for this good work. It had its small beginnings at the time of Dr. Coleman to whom our gratitude is due.

During the last 6 years, the College has become an integral part of the University of Agricultural Sciences which is growing fast and has a vast campus which a university necessarily requires. It is an institution of which every Mysorean must be proud of. Useful and necessary researches in the various branches of agriculture and allied subjects are being carried on with earnestness and sincerity and what is more satisfactory is that the success in these researches are conveyed to the fields where I find the agriculturist enthusiastically accepts them.

Work is being carried on to meet the peculiar problems of areas where they have scanty rainfall. This is vital to our economic progress. I hope we will have benefits of these researches very soon.

The Vice-Chancellor, his professors and others of his staff are dedicated men and I wish them all success in their service to the nation.

S. NIJALINGAPPA
Former Chief Minister of Mysore

BANGALORE

I am happy to learn that the Silver Jubilee of the Mysore Agriculture College will be celebrated and in that connection a Souvenir is being brought out. Agriculture being the main stay of our National Economy, requires more and more trained technical people to guide the farmers on scientific farming. The Agricultural College which has become a part of the Agricultural University has been the main source for such personnel.

I wish the occasion a brilliant success.

B. RACHAIAH

Former Minister of Agriculture in Mysore

As one who had the privilage of taking part in the starting of the Agricultural College, I am happy and proud to see the spectacular way in which the College, whose birth took place in a hurriedly assembled military shed, has grown into a great institution affiliated to a magnificent and manyfaceted University that has won international recognition and praise under the dynamic and devoted leadership of its eminent Vice-Chancellor Dr. Naik and his team of distinguished Professors and Teachers.

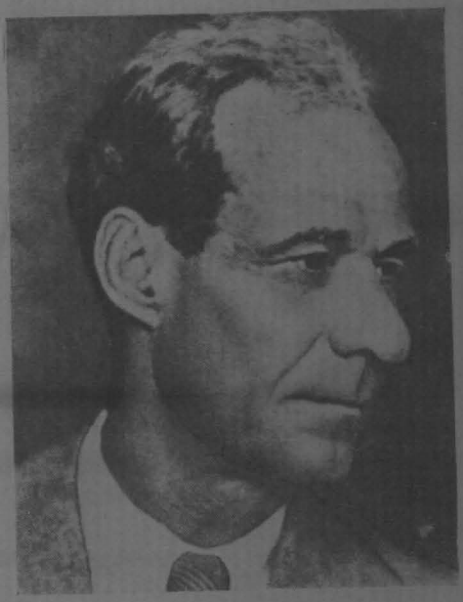
Need I say how keenly I look forward to witnessing its silver Jubilee?

BANGALORE

M.A. SREENIVASAN

Formerly Minister for Agriculture, Govt. of Mysore and Dewan, Gwalior State

PRINCIPALS OF THE AGRICULTURAL COLLEGE

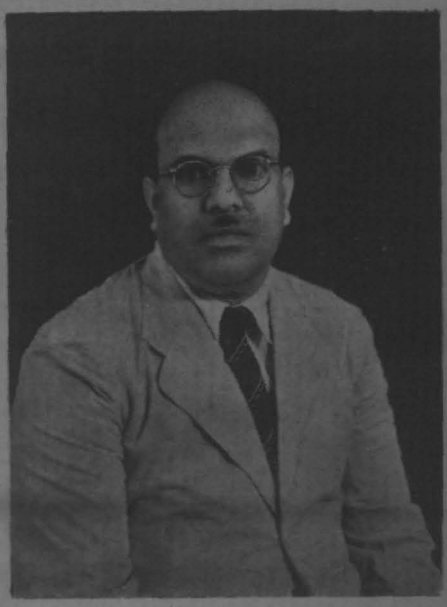


DR. LESLIE C. COLEMAN
First Director of Agriculture and Principal, Agricultural School, (1913 to 1935)

DR. B. T. NARAYANAN
(1-7-1946 to 16-2-1947)

MR. P. H. RAMA REDDY
(17–2–1947 to 31–3–1950)

MR. K. H. SRINIVASAN
(1–4–1950 to 12–11–1950)



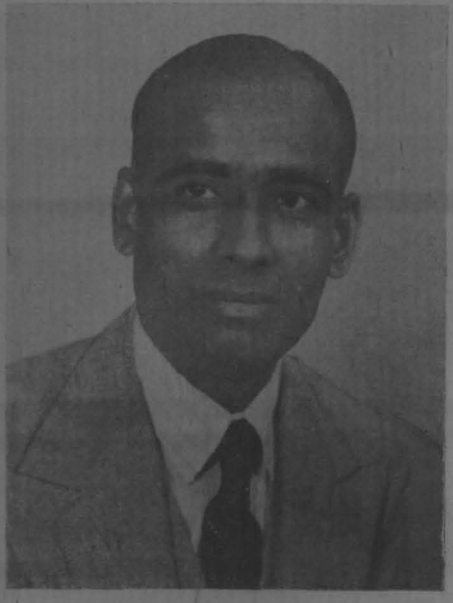
MR. M. MALLARAJ URS

(13-11-1950 to 25-9-1953)

DR. B. DASAPPA

(26-9-1953 to 13-7-1954 and
14-1-1955 to 22-7-1955)

MR. B. VENKOBA RAO
(14–7–1954 to 13–1–1955 and
23–7–1955 to 2–5–1962)



DR. M. PUTTARUDRIAH
(3–5–1962 to 15–12–1971)

REMINISCENCES FROM SOME OF THE PIONEERS

Dr. Leslie C. Coleman, the pioneer of agricultural research, extension and education in Mysore, conceived the idea of establishing an agricultural college five decades ago. But due to economic depression of the Thirties and lack of resources, his proposals were not pursued. It was due to the vision, zest and dynamism of Mr. M. A. Sreenivasan, the then Minister of Agriculture, that Dr. Coleman's idea took concrete shape one afternoon, early in 1946, in a small tent on the grounds of the Bangalore Town Hall, where the Representative Assembly was in sessions. I had just then assumed responsibilities of the post of the Director of Agriculture and I was entrusted with the privilege and task of executing this challenging idea of starting the agricultural college. Immediately, I submitted proposals to Government for starting the college at Hebbal and the Government order was received on 14-6-1946. I lost no time in drawing up the syllabus, in getting the approval and recognition of the Mysore University, acquiring from the Military some Lahore sheds and getting them erected at Hebbal to house the College, in deploying staff from the Department and selecting students for the first year. In this arduous task, I was ably assisted by the then Deputy Director of Agriculture, Dr. B. T. Narayanan who became the first Principal of the college

With 44 students, the College came into being in August 1946, hardly a few months after the Minister's instructions. I am happy and proud that this sapling in the planting of which I had some part to play, has grown into a mighty tree in the form of a full fledged University of Agricultural Sciences with big buildings, a huge staff and extensive campus, all in less than 25 years. One or two of the sheds put up in 1946, still remain to remind us of the humble origin of this great institution.

I sincerely hope that the Alumni that pass through the portals of this temple of learning will go out with zest and dedicated zeal of a true missionary and spread the gospel of the " Green Revolution " throughout the length and breadth of the State and outside, and earn laurels for themselves and for their Alma-Mater.

On this happy occasion of the Silver Jubilee of the Agricultural College, I join you all in wishing it many decades of fruitful growth and service to all farmers of Mysore.

K. H. SRINIVASAN
Retired Director of Agriculture in Mysore.

BANGALORE

I am happy to know that the Agricultural College, Hebbal, is celebrating its Silver Jubilee in April 1972. On this auspicious occasion, I feel it my duty to share with you my reminiscences of the Institution.

As I recollect, the Agricultural Research and Education activity at Hebbal dates back to around 1900 when Dr. Lehmann, who was appointed as Agricultural Chemist to the Government of Mysore, started the Research Farm at the present location But it was in 1913, under the pioneering zeal and guidance of Dr. Leslie C. Coleman that the Mysore Agricultural School was set up which built up high reputation as a centre for scientific agricultural education not only in South India but also in South Africa and Far Eastern Countries. Taking advantage of the facilities of the Farm and School that existed at the time at Hebbal, the Mysore Agricultural College was started in 1946 as part of the post-war agricultural development plan.

The College formed the nucleus of the University of Agricultural Sciences on October 1, 1965 in accordance with the provisions of the Mysore Act 22.

The current educational programme in the College, as I know, consists of courses leading to the B.Sc. (Ag.) degree of 4 years duration, the M.Sc. (Ag.) in Soil Science, Microbiology, Plant Pathology, Entomology, Agricultural Extension and Horticulture. It is gratifying to note that Ph.D. programme is also offered in the Departments of Soil Science, Microbiology, Entomology and Plant Pathology.

It is also noteworthy that all along the staff of the College have actively participated in agricultural research and extension work of the department and the approach has received particular significance after the advent of the University whose main emphasis has been on integration of teaching, research and extension aspects of agricultural activity.

In the past 25 years, the College has endeavoured to contribute towards agricultural improvement in the State through the provision of college level trained personnel to man the various plan development programmes and other activities.

The College has produced over 1,500 agricultural graduates and several post-graduates who are working with distinction in the State, elsewhere in the country and outside India in various capacities and held aloft the banner of their Alma-Mater. Quite a few of the graduates are involved in intensive agriculture based on science and technology, thus serving as vanguard of agricultural progress in rural areas. And also some of our alumni are playing significant role in the public life of the state promoting the welfare of the farming community.

May the Institution be a friend and a guide to the farmers in particular and humanity in general.

G. NARAYANA GOWDA
Former Minister for Agriculture in Mysore.

BANGALORE

When one is approaching the biblical age of three score years and ten, memories of events which happened a few months ago, let alone 25 years, are apt to be slightly blurred and often prone when recounted, to be furbished usually in favour of the recounteur. Nevertheless, my brief association of a little over 13 months during the formative and infant stage of the college was such a happy interlude in my service that I still have nostalgic and pleasant memories of the very exciting, challenging and enjoyable time I had during that period.

It was known some time about the end of 1945 that an Agricultural College was in the offing and that no decision had yet been taken whether the University of the Department should be entrusted with the responsibility for starting the College and where it was to be located. It seems to have been finally settled, in view of the urgency to establish the college during the coming academic year, to entrust the Department with the starting of the college and its attendant duties. In consequence, much to my surprise, I had an urgent summons some time about March/April 1946 from Mr. M. J. Narasimhan, the then Director of Agriculture, who asked me to get in touch with the University authorities at once and set about the preparation of a draft prospectus and calendar in consultation with them. I was also asked to put up a list of suitable sites for establishing an Agricultural College, keeping in view the availability of at least 100 to 150 acres of agricultural land with irrigation facilities. Mr. Narasimhan added, in his inimitable way that he would be glad to have the draft and the list in about a month's time.

It was my good fortune that Mr. Justice Singaravelu Mudaliar was the Vice-Chancellor of the Mysore University, at that time. With his mature guidance and interested assistance, the preparation of the prospectus proved to be a very simple matter, having on hand guide lines in similar publication from the earlier established agricultural colleges in India.

The location of the site proved a little more exciting. Of the several spots thought of, apart from Hebbal which was a permanent stand-by, Cheluvamba mansions in Mysore was one of the places on the list. With its palatial main building with plenty of room both for our immediate needs and any expansions thereafter, the number of our buildings for housing inclusive of hostel space and nearly 150 acres of land with irrigation facilities, the mansion seemed to be an ideal spot to locate the college. Proximity to the University and rich agricultural land in Cauvery basin was an added attraction. But, alas, even before we could think of organising the place, we were told that Maharani's College for Women, Mysore, had the preference over us and the building had already been alloted to them. The result was the college came to be located at Hebbal and the facilities that were available at the Agricultural School and farm were to be shared for the present, pending other arrangements.

In view of the limited facilities it was agreed to entertain not more than 25 candidates for a start. With the ground cleared so far and with only 6 weeks still left for starting the college our immediate problem was one of accommodation and concurrently one of transport facilities.

The major concern was to find hostel accommodation for these 25 students, in addition to those from the school, who were already in the hostel; to realign and adjust the timing of lectures, the practical and field work without seriously affecting the work of the school, in as much as we had to share the accommodation available with the school authorities. Here again, I had the good-will and very close co-operation of my friend Mr. McIsaac, the then Vice-Principal of the school. He readily agreed to the suggestions made by me and my colleagues and the programme was adjusted to suit both units. More, the students of the school themselves came forward with one voice to share whatever accommodation they had with their new comrades, which helped me a lot. Later Dr. Dasappa and I made it an invariable rule to spend part of the evenings with the boys and share a meal at least once a week. This helped in creating an atmosphere of good-will and comraderie all through.

Till permanent arrangements were made at the college site, laboratory facilities available at the Department's main sections were to be used. The co-operation of the heads of sections and their staff in this regard, who also assisted me in organising the lecture classes cannot be sufficiently lauded.

Selection of candidates went according to schedule. Things were now well set to start the college as intended by the end of June. Again, to my surprise, I was asked to take over as Principal.

The college started with a small whole-time staff consisting of my friend and colleague Dr. B. Dasappa and Mr. R. S. Iyengar in addition to myself and an office staff of 4, headed by Mr. Hanumantha Rao and the versatile Mr. Ramachandra Rao. The Animal Husbandry department was represented by Dr. Rudraya.

Without any formalfan fare or flourish, the college commenced its work as scheduled, with the good wishes and blessings of Mr. M. A. Srinivasan, who was primarily responsible for the establishment of the college, Mr. M. Seshadri who had recently taken over as Minister for Agriculture and last, but, not least Mr. K. H. Srinivasan, who had succeeded Mr. M. J. Narasimhan as the Director and of course Mr. M. J. Narasimhan, being assured of their guidance and assistance my colleagues and I entered upon this new venture with faith and hope.

Because of the distance to be traversed both by the staff and students to and fro the college and the city, the Government were pleased to provide a jeep for the staff and a van-*cum*-bus for the students. It was great fun using these vehicles. The jeep right from the city to the college and back was a sight for the Gods to see. We were often 11 in the jeep and never less than 9 in any case, the jeep collecting the members from one end of Basavanagudi through the city. Malleswaram and on to the college site. We of the permanent staff were called the starvation brigade. Not one of us could answer to more than about 125 lb in weight. It is no wonder that 11 of us could sit in a jeep intended for 6. Equally so with the boys. The students made a picnic run to the laboratories and back.

These 25 students turned out to be a remarkable lot. They took it all in good spirit, despite short comings of accommodation, the primitive nature of the lecture halls and the need to shuttle between the Department of Agriculture laboratories and the college campus at odd hours of the day and not a word of protest was heard. They felt, each one of them, that they were partners in the setting up and establishing of the institute. They maintained a close association with their fellow students from the school and sports activities were run on a composite and integrated basis. Neither Dr Dasappa nor I being knowledgeable in sports matters, the students themselves took it over and produced remarkably good teams. The next most pressing problem was to have additional accommodation created as early as possible Pending preparation of plans etc. for the construction of permanent structures both for present use and future requirements, Government readily sanctioned the construction of 3 large nissen sheds, the legacy of the II World War. to relieve congestion in the hostels and office and to bring part of the laboratories to the college site. I understand that the plans we then prepared form quite a portion of the current university campus.

I was again lucky in finding Mr. Lakshman Rao, Executive Engineer in Mysore, as the Divisional Head of the Public Works Department in the Bangalore District. He spent practically all his spare time on this project and had the work completed by the end of January, 1947. It so happened that I had the pleasure of moving into one of these units a month before I left the college to go back to the Department. We even had a combined College and School Day, one day before I left.

It is with pride that I see the small institution with whose installation I had a very intimate part, should now have grown up to be a University of national and international fame and it gives me no less pride to know that all my batch of 25 students have made their mark in and out of India and that several of them were closely connected with the starting of this University and in large measure are responsible for its standing today in the agricultural world.

Is it any wonder that I feel a glow of happiness when I recollect my association with the College? With this amount of good-will, support and co-operation and never a word of dissent from the tob echelon of Government to the last in the line in the department and the College; more, the support I received at every stage from both the college and school students made it the most satisfying period of service.

B. T. NARAYANAN
Retired Director of Agriculture.

The Development of Hebbal as a Centre of Agricultural Education

B. V. VENKATA RAO*

MODERN farming is an economic activity which involves knowledge on the part of the farmer, skill in applying this knowledge, the physical ability to execute this knowledge and lastly the will or determination to apply the knowledge to farm practice. The main object of Agricultural Education is the deliberate experience which leads to a change in his future behaviour pattern contributing to agricultural growth. In pursuance of this goal, Agricultural education should naturally comprise: (i) the direct education of the farmer including self-cultivating farmer, and members of his family assisting him in farming work, like tenants and agricultural labourers, (ii) those directly serving the farmers such as extension workers, agricultural officers and subject-matter specialists assisting them, (iii) those serving the farmers indirectly such as field workers in the fertilizer and pesticide industry and workers in the area of agricultural produce marketing and quality control and last but not the least agricultural policy makers and administrators. Right from the commencement of the century, Hebbal has played a significant role as a centre of agricultural enlightenment in the State and in this article an attempt has been made to present the salient features of the same.

HEBBAL FARM

Realising the need for modernisation of agriculture in the State with the help of science and technology, the farsighted earlier administrators of Mysore took the pioneering decision of starting the Department of Agriculture as early as 1899. The Department started functioning with the appointment of one Dr Lehmann, a German by nationality, as the Agricultural Chemist to Government. The laboratories of the Department of Agriculture at Bangalore and the Experimental Farm at its present location at Hebbal were established by him at the beginning of this century.

A Canadian by name, Dr. Leslie C. Coleman succeeded Dr. Lehmann in 1907. He guided the destinies of the Department for well over a quarter of a century. He was largely responsible for the all round development of the activities of the Department. He started the divisions of Entomology, Mycology and Botany. It is he, who was responsible for evolving remedial measures of spraying Bordeaux mixture against ravaging Koleroga of Areca palms and coffee, and saving these valuable plantations from extinction. The Entomology Division under his guid-

* University of Agricultural Sciences, Bangalore.

ance studied the bionomics of many major crop pests and worked out control measures. The Economic Botany Division under his leadership paid attention to crop improvement work. The work initiated by him on the improvement of ragi which is the main staple food crop of the working and peasant population of the State needs special mention. The information gathered were transmitted to the farmer through literature and field demonstrations.

School

The Mysore Agricultural School at Hebbal was started in 1913. For the first few years, it offered a Post-Secondary Certificate Training Course of 2-year duration which was soon converted into a Post-Secondary 3-Year Deploma Course in Agriculture. Dr. Coleman himself, as the Principal and the Heads of Scientific Divisions were directly responsible for teaching in their respective areas The school earned a great reputation and attracted students from other States of India and outside from Ceylon, Burma, Malaya, South Africa and other parts of the world. The admissions to the school were stopped in 1957 when the need for diploma holders had ceased with graduates in agriculture being available It was during this period that agriculture was introduced as an optional subject of study in selected middle and high schools in various parts of the State The concept of integration of teaching, Research and extension in the area of agriculture, the current philosophy of our Agricultural Universities was exemplified in the real functioning of Dr. Coleman and his scientific colleagues who were at once actively involved in research, teaching and extension work of the Department those days.

Agricultural College

The economic slump of 1930s resulted in the toning down of the tempo of the Departmental work. This situation soon changed and there was a revival of public interest in agriculture as a result of serious food shortages experienced arising out of the Second World War. The 'Grow More Food Campaign' was inaugurated to effectivise food production through numerous incentives to farmers such as financial and technical assistance It was soon realised that this was only an expedient and more basic efforts were required to overcome the widening gap between food production and requirements. The Government of Mysore decided to start the Agricultural College at Hebbal using the then existing building facilities on the farm and the laboratories of the Department at Bangalore, with the object of securing well-trained technical personnel in large numbers required for expansion of activities of education of the farmer in the newer techniques of agriculture developed by painstaking research in the laboratories and on the experimental farms.

The College started in 1946 with a 3-year degree course leading to the Bachelor's Degree in Agriculture, with a pass in the Intermediate Examination

of any recognised University as an admission requirement. The College was affiliated to the Mysore University With the change over to 3 years degree course in Arts and Science faculties in 1958, the duration of the B.Sc. (Agri.) course was extended to 4 years to include one-year Pre-Professional class. The admission capacity to start with was 48 Though the demand for admission was keen in the first 2 to 3 years, it slumped off in the early years of 1950s, as it happened in other parts of the country This was mainly because of lack of employment avenues for graduates in agriculture which was limited to a few jobs in the agricultural departments. At one time even the question of closure of the College was seriously discussed The position improved with the launching of the first five-year developmental plans In keeping with the demand, the admission capacity has been steadily increased and it is at present 220

As for the facilities for training, the College had to depend upon the resources of the several research sections in the initial stages, including laboratory space and equipment As before, the Departmental Research staff were involved in a big way in the teaching programme. The physical facilities were rapidly developed at Hebbal itself in temporary constructions till the present spacious two-floor building with a 400 seat capacity Auditorium was completed and occupied in 1959 The experimental farm with its 180 acres of dry land and 22 acres of irrigated land has all along provided effective training ground for the student for practical training in agriculture. The Engineering Workshop on the Farm has been adequately developed to offer facilities of training in farm machinery and other related aspects. The Chemistry, Entomology and Pathology Laboratories compare favourably with any other top class institution in the country both as regards lay-out and equipment and provide adequate facilities to training of students in the respective disciplines. Intensive training in agricultural extension work is offered to students in the Bangalore North Taluk Block Area, attached to the College for the purpose.

The College has been conducting every year refresher courses of 4–6 weeks duration for agricultural extension workers from the Development Blocks in the different parts of the State so as to appraise them of the latest advances in the various areas of crop production, besides similar short courses for the benefit of officers of agriculture and administrative departments involved in State's Development work. One of the very important features of work of the College from its inception has been its participation in farmers education through periodic meets such as conferences, seminars, field days and short courses for farmers and farm leaders engaged in practical agriculture

Agricultural University

In consequence of the growing feeling among the leaders as well as the general public during 1950s that the organisation of agricultural education needed a revita-

lisation and reorientation in order to infuse increased efficiency in the realm of agricultural production, the concept of agricultural universities based on the model of Land-Grant Colleges of U.S.A. was accepted by the Government of India. In pursuance of the same, Government of Mysore in consultation with USAID Experts initiated necessary legislation to facilitate starting of the Agricultural University in Mysore. Accordingly, the State Legislature approved the Act No. 22 of 1963, which provided for establishment of the University of Agricultural Sciences, with State wide jurisdiction, with the objective of (i) providing higher education in the areas of Agriculture, Horticulture, Veterinary and Animal Sciences, Fisheries, Agricultural Engineering, Home Economics and Allied Sciences, (ii) furthering frontiers of knowledge through systematic research in the above disciplines and extension or transmission of the knowledge gained through research to rural people for adoption in their field practice and day to day life.

A new era was ushered in the history of the College, with the inauguration of the University on August 21, 1964 by Dr Zakir Hussain and the pursuant transfer of the control of the Agricultural College, Hebbal, along with other institutions to the University with effect from October 1, 1965 as per provisions of the Act.

Trimester System

The very first step, the University took on assumption of the responsibilities for agricultural education was, the introduction of the teacher centred Trimester System of education with internal student evaluation system in place of the annual external examinations, commencing from the academic year 1966–67. The main object of the new system is the continuous day to day evaluation of the performance and progress of the student as in the American educational institutions so as to keep the student's interest in studies uniformly alive. The year is divided into three terms or Trimesters of 14 weeks duration each. Instead of teaching a subject for 8–9 months with a final examination at the end, all subjects are split up in o self-contained units designated as courses, capable of being taught in a specified number of hours in a Trimester Each course is assigned credits, based on the load of instruction the student undergoes, an hours theory or 3 hours laboratory or field work per week through the Trimester representing one course-credit. Each student selects 3 or 4 such courses at a time on the advice of his teacher, the total permissible load for a student at a time generally not exceeding 16–18 credit hours Each teacher who actually teaches or as he is called "Course Instructor" evaluates his students performance through a variety of ways such as quizzes, fortnightly, monthly, mid-term and final tests, of half to one hour duration, home or laboratory exercises, or term papers and grades the students on the basis of his cumulative performance at the end of the Trimester The student earns eligibility for a degree when he accumulates the required number of credits after successfully undergoing the prescribed courses of instruction, designed to give a broad based know-

ledge and skills in any selected field of study. For instance, a student has to secure 192 credits with a grade point average of 2·25 to secure a B.Sc. (Agri) Degree.

Post-Graduate Studies

The institution of Post-Graduate Programmes leading to M.Sc. (Agri.) and Ph.D. Degrees in the College in 1966 is one of the significant events in the history of the College. Enrolment facilities for M.Sc Programmes are currently available in the subject of Soil Science, Agricultural Microbiology, Entomology, Plant Pathology, Agricultural Economics, Agricultural Extension and Horticulture. In the subjects of Soil Science, Agricultural Microbiology, Entomology and Plant Pathology facilities are available for enrolment for Ph.D Programmes. These Departments have been well equipped with competent staff as well as instrumentation, laboratory and field facilities for successful working of the Post-Graduate Programmes.

Integration of Teaching, Research and Extension

One of the Philosophical foundations of the Agricultural Universities is the integration of the triple aspects of agriculture, *viz*, teaching, research and extension activities. In accordance with this objective, every teacher devotes part of his time which may range from one-third to two-thirds, to research and extension activities. All teachers are actively involved in research as per approved programmes and the research output arising out of the teachers and post-graduate students work constitutes a major portion of the University's research contribution.

Concluding this brief narration of the progressive development of Hebbal as a Centre of Agricultural Education over the last 70 years and more particularly, the role of the Agricultural College in the last 25 years, it may be recorded with satisfaction that the objectives of agricultural education set out at the beginning, have been fulfilled in a large measure. Hebbal has built-up for itself a name as an information source for farmers in the State. It has trained calibre men who through their teaching and research efforts have accumulated a fund of valuable information of significance to farmers. From the portals of this institution, have gone out over 1 500 graduates who are serving with distinction farmers, directly through Government Development Departments and indirectly through agro-based industrial organisations There is yet another very important group of persons directly coming out or deriving inspiration from this institution who constitute the rising generation of rural leadership. They, through their personal example of successful farming or through the provision of leadership, have set in motion a rural emancipation movement We are proud of the past, only in the sense that it is a base for ever expanding service to the cause of Agriculture in Mysore in the years ahead.

Soil Science and Agricultural Chemistry in Mysore : 1946–71

B. V. VENKATA RAO*

THE Mysore Department of Agriculture started on its feet with the appointment of Dr. Lehman, a German by nationality as the first Agricultural Chemist in 1899. Till he relinquished his office in 1907, Dr Lehman was responsible for the initiation of work for the all-round development of agriculture in the State. With his characteristic foresight and thoroughness, he took steps to establish the Agricultural Research Laboratories at Bangalore and the Experimental Farm at Hebbal at the beginning of the century. The Agricultural Chemist's Laboratory adjoining the Central College was one of the very well conceived and equipped laboratories for the type of work intended. Dr. B. Narasimha Iyengar who also had his training at Gottingen in Germany succeeded Dr Lehman as Agricultural Chemist and was largely responsible for organising systematic work on soil-crop studies with the object of incorporating them in field practice. The Division developed on the solid foundations laid by these men and contributed to accumulation of considerable amount of information on problems of crop production as concerning soils, manures and fertilisers, crop quality and other allied aspects Dr B. T. Narayanan, Mr. H. Shiva Rao, Dr. S V. Govinda Rajan, Mr S. S. Sirur, Dr. A. D. Desai, Mr. P. Ambadasa Rao and Dr. N. G. Perur occupied the post of Agricultural Chemist for varying periods of time.

There was a very intimate involvement of the Agricultural Chemistry Division with teaching work in the College since its beginning in 1946 and the teachers of the College with Research Work in the Division. They functioned together and contributed towards progress of work in Research, Teaching and Extension in soils and agricultural chemistry in the State. In this article, an attempt has been made to high light some of the aspects of work done in the area in the past 25 years.

SOILS

There is a great diversity in the agro-climatic patterns in different parts of Mysore State. The rainfall which is of the order of 100–150 inches per annum in the Western Ghats and the Coastal belt decreases to less than 25 inches in the eastern and north-eastern districts leading to regions of drought and scarcity conditions. Agriculture on nearly 9 million hectares out of a net area of 10·04 million hectares has to depend on the vagaries of monsoon (Naik *et al*, 1971).

The crops grown in the State are equally varied They consist of the common food crops like paddy, ragi, and jowar; cash crops like cotton and sugarcane;

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plantation crops like coffee, arecanut and coconut and spices like cardamom and pepper.

Soils are found to vary due to the combined effect of climate and associated vegetation, on the geological parent material Sirur (1958) identified seven broad soil groups. They were (i) the base satured Trap soils derived mainly from Deccan trap and occupying large areas in Belgaum, Bijapur, Gulbarga and Bidar Districts being light in colour on sloping lands and dark and deep in low land areas. (ii) Mixed red and black soils occur side by side in the districts of Belgaum, Bijapur, Dharwar, Raichur and Bellary These soils are derived either from gneisses and schists of Dharwar series of rocks, and also from sedimentary rock formations known as Cudappa and Vindhya series which include sand stones, shales, limestones and other altered products. (iii) Red soils derived from acidic granites showing no regular variation in depth are light in texture varying from sandy to gravely, lying in Kolar, Bangalore, Tumkur, Mandya, Mysore and parts of Hassan, Chikmagalur, Shimoga and Chitradurga Districts (iv) Deep black soils characterised by great depth, deep dark colour and high clay contents. They are derived from a variety of parent materials such as trap, gneisses and schists and sedimentary rocks and often appear to be of mixed origin. They are mostly transported soils and found in the river basins. They are known for high base saturation, moderately to high alkaline reaction and show accumulation of lime and soluble salts in lower layers. (v) Red loams occur in a long narrow strips in the districts of Shimoga, Chikmagalur, Hassan and Coorg They occur in valley portion adjacent to the foot hills of Western Ghats supporting plantation crops. (vi) Laterites and Lateritic soils derived from laterites found in high rainfall regions of North and South Kanara, Belgaum, Western parts of Shimoga, Chikmagalur, Hassan and Coorg Districts : they are highly leached, show low base saturation and are acidic in reaction and (vii) Dark brown soils occurring in a small area in the eastern parts of Coorg District and contiguous with similar dark coloured soil in the South-Western part of Mysore District which forms a forest belt. Venkata Rao (1968) broadly classified the soils into three groups. *viz*, (i) Red soils including red loams, red sandy soils and coastal red sandy alluvial soils, (ii) Black soils and (iii) Laterites and lateritic soils based partly, on the specific soil surveys carried out in the different areas of the state and partly on the experience and information gained in the course of agricultural extension activities. He presented a soil map showing regions of red loam, red sandy loam, laterites, coastal alluvium and Black soils along with description of typical profiles including their physico-chemical properties.

Soil Fertility and Fertiliser Use

With the advancement in understanding the soils in different agro-climatic conditions, need was felt to improve the fertility of soils to a reasonable level. As far back as 1944, Dr. B. T. Narayanan pointed out that the productive efficiency

of our lands was just under 50 per cent. This low fertility was attributed not due to any inherent defect in our soils, but to a continued state of under nourishment and often no nourishment combined with indifferent cultivation Mysore State can claim to be in fore front with a long period of activity in the study of soil-crop response dating back to 1899. Dr Narayanan, in a review pointed out that "Dr Lehmann laid down the fundamental lines in which several problems concerned with soils and crops should be conducted and the manner in which the results should be conveyed to the farmers" Dr Lehmann and his associates carried out comprehensive investigations including pot-culture and field experiments in both wet and dry lands on manurial requirements of several crops including important cash crops such as coffee and sugarcane. Among the more notable and fundamental contribution was the investigations on "Red soils and their manurial requirements" (Narasimha Iyengar, 1923). He demonstrated through his pot experiments the necessity of both nitrogenous and phosphatic fertilisers in increasing the yields of ragi, and on paddy on a cultivator's land. The yield was found trebled during the first year of manuring. From his experiments he concluded that even with small quantities of fertilisers but with sustained and long continued application, it was possible to substantially increase the crop yields and build up soil fertility. He did not find any response to application of potash.

With the advent of statistical methods in agricultural experimentation several investigations were conducted with different manures and fertilisers, to determine their effects on soils and crops and to evolve correct techniques of the time and methods of their application to attain the best results Among the notable items of work that of Govindarajan and Venkata Rao (1952) was on the time of application of nitrogenous fertilisers for paddy From these experiments it became possible to make definite recommendations in regard to application of half the dose of nitrogenous fertilisers, 4–6 weeks after transplanting to obtain best results. Govindarajan and Venkata Rao (1957) carried out detailed investigations on the direct application of anhydrous liquid ammonia They fabricated an inexpensive simple applicator, suitable for use with local ploughs. They found that ammonia on nitrogen basis, was equal to ammonium sulphate in its effect on yield of sugarcane and paddy. The losses due to volatalisation during application was found to be negligible (Venkata Rao and Govindarajan, 1955). Govindarajan (1955) compiled manurial formulae for the principal crops of the Mysore State in a departmental bulletin entitled "Manures and Fertilisers" Venkata Rao and Govindarajan (1956 *a* and 1956 *b*) studying the influence of manuring on the yield and composition of paddy and ragi, observed that the paddy crop responded favourably with incremental additions of N and P_2O_5 upto 45 lb of N and 45 lb of P_2O_5 in the form of ammonium sulphate and superphosphate respectively. In case of ragi, the application of 45 lb of N and 45 lb P_2O_5 increased the yield of grain and straw in monsoon of 1950 by 53 and 43 per cent over control; 20·8 and 11·8 per cent over control in summer 1951; and 47·4 and 34·1 per cent over

control in Monsoon 1951. These results indicate that nitrogen appears to have a complementary influence on the phosphorus utilisation.

Venkata Rao (1964) summarised the results of investigation on the effect of fertilisers in increasing the yield of ragi. The placement of phosphatic fertilisers at a depth of 3 to 6 inches in the root zone increased crop yields as also recovery of applied phosphorus considerably over the broadcast method (Venkata Rao and Govindarajan, 1951). Similar application of phosphorus mixed with FYM either at planting or a month before planting resulted in increased ragi yield (Venkata Rao, 1957).

An experiment on application of fertiliser for rainfed ragi was conducted at Hebbal between 1927–37. In this experiment the effect of N in the ammoniacal nitrate and organic forms alone and in combination with P and K was studied. The results indicated uniform yield increases of the order of 20 per cent to applications of moderate doses of nutrients, *viz*, 20. 30 : 20 of N, P_2O_5 and K_2O respectively. N in the form of chilean nitrate was found to be better than sulphate of ammonia There was also an indication of the necessity of application of P and K fertilisers along with nitrogenous fertilisers for satisfactory crop yields (Venkata Rao and Situr, 1959).

Another long range study (Venkata Rao and Govindarajan, 1956*c*; Venkata Rao and Shankar, 1960) carried out in microplots with ragi as a test crop showed that increased soil phosphorus status brought about by continuous heavy applications of phosphates materially improved the fertility of red soils. Studies were also conducted to follow the build up of phosphorus in the soil through heavy applications of phosphate and its residual effect on crop growth (Venkata Rao and Govindarajan, 1963). The experimental plots were subjected to differential treatments with phosphatic fertilisers for eight seasons continuously, commencing from 1951. The treatments consisted of 0, 10, 20, 40, 80 and 160 lb P_2O_5 per acre in the form of single superphosphate applied over a common dose of 40 N per acre. At the end of eight seasons, there was a marked, graded increase in the total and citric acid soluble P_2O_5 both in surface and sub-surface layers, according to the increase in the dose of phosphate applied. The plots were then cropped with ragi for four seasons and legumes for two seasons without further application of phosphorus. Yields increased with increasing doses of P_2O_5, the increase being of the order of about 25 per cent at 20 lb level and over 60 per cent at 160 lb level. They concluded that the gradual stepping up of the soil phosphorus status by repeated application of heavy doses had a pronounced effect on crop yields and made for more efficient utilization of applied N by cereal crops.

An interesting study related to the influence of soil phosphorus status on nitrification by Shankar and Venkata Rao (1966) revealed that the process of nitrification was essentially independent of the soil phosphorus status.

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Another notable contribution in the field of soil fertility and plant nutrition was the study on the influence of phosphorus on nitrogen utilisation by ragi crop (Venkata Rao and Govindarajan, 1956 *a*). Ragi is the most important food crop in Mysore State forming the staple food for the majority of the population. The plot experiment consisted of application of P_2O_5 of the rate of 0, 10, 20, 40, 80 and 160 lb in the form of superphosphate over a basal dose of 40 lb N per acre. Ragi was taken as a test crop in summer and monsoon 1952–54. There was steady increase in the yield of crop with increasing doses of P_2O_5 upto 80 lb P_2O_5. The utilisation of applied nitrogen was improved with application of increased doses of P_2O_5.

The feasibility of phosphorus build up in red soils of Mysore State through fertilisation and its influence on crop yields was stressed by Venkata Rao and Govindarajan (1963). It was shown that the residual effects of application of increasing doses of P_2O_5 continuously over 8 seasons increased the yields of ragi, horsegram and sannhemp, in the succeeding six seasons without any further application of fertiliser phosphates Sannhemp seemed to mobilise large quantities of atmospheric nitrogen with increase in soil phosphorus (Venkata Rao and Govindarajan, 1954; Venkata Rao and Shankar, 1960; Venkata Rao and Sadashivaiah, 1968).

A brief review on several experiments conducted in Mysore State for 25 years at Babbur Farm, Visveswaraya Canal Farm and Hebbal Farm on the response of sugarcane was presented by Venkata Rao and Bheemasen Rao (1960). They suggested that the economic dose of phosphorus fertilisation at the rate of 45 lb P_2O_5 per acre arising out of previous experimentation was found to be basically sound though the responses were not always consistent. Various forms of phosphates such as "Amophos", "Nicphos" and others were tried. There were indications to show that increase in dose of N needed proportionate increase in dose of P_2O_5. Bone-meal gave better results with organic sources of N.

Potassium is one of the major plant nutrients Earlier work in Mysore and elsewhere in India have not indicated any response to application of potassium to either paddy or sugarcane. The non-response to potassium application may be presumably due to the gradual release of soluble potassium from the potash rich minerals found in our soils as a result of their weathering This source of K_2O may be of greater significance in meeting the plant requirements than the K_2O supplied through fertilisers. In view of the intensive production drive launched in post-war years to meet the food deficit through the use of fertilisers, the necessity was felt of the critical reassessment of the need for potash, in manuring cereal crops. With this object in view experiments were started at the Agricultural Research Stations at Hiriyur, Mandya and Nagenahalli and also in the pot culture house at Bangalore on Paddy and Ragi in 1954 The field experiments conducted on paddy did not show any significant response to application of K_2O at 30 lbs K_2O level except for indications of response at Nagenahalli where the soil

were distinctly acidic in reaction and low in available K_2O. The results of pot-culture experiments indicated inconsistent influence of K_2O alone or in combination with N or P_2O_5 at any of the levels tried either in regard to the yields or composition of paddy or on the uptake of the nutrients (Venkata Rao and Sirur, 1958).

Perur *et al.* (1969) reviewing the potassium status of Indian soils and the areas of acute deficiencies and responses in Mysore State, based on soil test values for nearly 7,000 soil samples collected from different parts of Mysore State, grouped soils in the "Low", "Medium" and "High" categories. It was found generally that soils formed under high rainfall conditions were low in available potassium. Paddy soils of Mangalore, Nagenhalli, Poonampet, Sirsi and Kumpta had low K content and were found to respond to K fertilisation. Both from soil test results as well as from the fertiliser experiments several areas in the State were found to be deficient in K and responded to K application. Venkata Rao and Govindarajan (1954) working with culture solutions showed that in situations of high magnesium concentrations, its ill-effects on potassium utilisation by rice plant could be mitigated by supplying soluble calcium and altering the ratio of potassium to divalent ions instead of resorting to applications of heavy doses of potassium fertilisers.

Though most of the soils of Mysore State are generally not deficient in K, the increased use of nitrogenous and phosphatic fertilisers may render the soils defiecint in the element. With a view to assess the K fixing capacities of typical soils of Mysore State, a study was conducted using KCl and KOH as sources of K under wet conditions. The results indicated that the K fixation was greater in black soils than in red soils. The greater fixation of K in black soils was attributed to the presence of expanding type of clays. The red soils contain non-expanding clays. The application of K in the form of KOH was seen to increase the fixation capacity presumably due to the effect of pH. There was no pronounced effect of organic matter on K fixation (Badiger and Venkata Rao, 1969).

In an experiment to study the influence of magnesium salts on the yield and uptake of phosphorus and potassium by potato in red soils, Venkata Rao and Govindarajan (1958) found that magnesium in combination with nitrogen alone appears to increase the yield whereas no advantage was noticed when magnesium was added in addition to NPK and increased absorption of P and K was noticed when Mg was applied.

Based on a series of experiments conducted on groundnut in red soils at Hebbal both under rainfed and irrigated conditions, Venkata Rao and Govindarajan (1954; 1960), reported that groundnut under rainfed conditions responded to applications of phosphate and also to calcium applied as lime at 100 to 200 lb per acre annually. Besides increased pod yields, there was better pod filling contributing to increased yield of oil per acre. The crop responses under irrigation

to various manurial treatments were similar, the same being appreciable to phosphates alone and in combination with potash, while nitrogen application did not show any benefit.

The occurrence of phytotoxic substances in some Hebbal soils was studied by Lillaram (1970). The soils contained upto 9 ppm of *p*-hydroxy benzoic acid and 12 ppm of dihydroxy stearic acid. The effect of these two acids on the germination and growth of ragi and rice were observed. Ragi and rice seedlings could tolerate upto 20 and 10 ppm of *p*-hydroxy benzoic acids and upto 15 ppm of dihydroxy stearic acid (Lillaram *et al.*, 1970). The effect of application of heavy doses of N on the concentration of the phytotoxic substances was studied by Lillaram and Venkata Rao (1971). With the application of 40 to 160 lb N per acre in multiples of 40 lb/ac, the pH of the soils diminished from 6·1 to 4. *p*-Hydroxy benzoic acid content was about 7–8 ppm, Ketones were in the range of 3·8 to 4·5 ppm and there was little or no dihydroxy stearic acid.

Salt Problem in Crop Production

In Mysore State, out of 10·04 million hectares of sown area, 9 million hectares have to depend on the vagaries of monsoon rains (Naik *et al.*, 1971). The irrigated acreage, both under major and minor irrigation projects, constitutes about 1·1 million hectares. Roughly one-fourth of the area both under irrigation and rainfall are known to suffer on account of salt affliction.

Venkata Rao (1967) examined several typical soil profiles from problem areas of Mysore State for their physico-chemical properties to assess the nature and extent of salt affliction in them. At Babbur, the soils were found to be saline-alkali with normal hydraulic conductivity; Mandya soils indicated the ill-effects of irrigation due to rise in the water table. Karl soils of Nargund are noted for saline-sodic nature with fairly good permeability. But they have a tendency to accumulate boron. The free lime in this soil appears to promote aggregation of soil particles.

Perur (1971) reported the extent of Khar and Karl lands along with other salt afflicted soils in Mysore State and described their characters and method of reclaiming them Soluble silica and fluorides in some surface and ground waters from different geological formations in Mysore were studied by Deshpande *et al.* (1971). Well waters were slightly acidic to neutral in reaction while tank waters were neutral to slightly alkaline. Well waters from Anekal, Ramanagaram and Hoskote Taluks have high fluoride (more than 1 ppm) and soluble silica content greater than 2 ppm indicating the equilibrium of waters with two phase system of kaolinite-montmorillonite formed during the weathering of silicate minerals. Soluble fluoride and pH and soluble fluoride and soluble silica were significantly

correlated in tank waters. Silicate equilibria were found to influence the composition of waters.

Amelioration of Salt Affected Lands

The results of laboratory studies indicated that the application of superphosphate had beneficial effect on the physico-chemical properties of sodic soils (Venkata Rao and Jagannath, 1968).

In many parts of State, the well waters are brackish. In a laboratory study, the possibility of using such brackish waters for reclaiming alkali soils was examined by Badiger *et al.* (1969). Soil samples from typical alkali situations in the State were leached with highly saline waters (422·37 m.e /l) similar in composition to that at Hiriyur in the Vanivilas Sagar command areas. The study suggested that high salt laden water in which the concentration of calcium and magnesium constituted one-third of the total cations, was found more effective than gypsum in improving hydraulic conductivity of soils.

Rao *et al.* (1970) tested the salt tolerance of paddy varieties, *i.e.*, IR-8, Taichung-65 and S.R. 26B by using osmotic concentrations of salts of $CaCl_2$, NaCl, Na_2SO_4, K_2SO_4 and KCl from one to eight levels. Their study suggested that K_2SO_4 was least harmful while $CaCl_2$ was most harmful for germination and NaCl was next to $CaCl_2$ in suppressing germination. Varieties IR-8 and Taichung-65 were significantly affected by Na_2SO_4 while S.R 26B was not affected.

In a study made on the germination of ragi seeds in solutions containing various ratios of Na/K at different osmotic concentration Badiger *et al.* (1970) found that when the ratio of Na/K was 1·0, germination of Hamsa variety of ragi was highest. This study suggests the possibility of improving seed germination on sodic media by narrowing Na/K ratio. The respiration rate of germinating rice seedlings (variety IR-8) under various levels of ESP (from 7·4 to 55·9) in red sandy loam soils of Hebbal was studied in plant growth chamber under controlled conditions. It was observed that respiration rates increased faster with increased levels of ESP during the first 86 hours of growth which was considered to be due to the rapid conversion of starch to sugars. The respiration rate fell down rapidly during the subsequent interval of 86 to 150 hr in the case of high ESP levels, clearly indicating that the stored energy in the seeds was exhausted by 86 hr and the plants could not synthesise their food for lack of energy due to high osmatic tension in the soil solution The yield of the crop decreased markedly beyond ESP levels of 14·0 (Appaiah *et al*, 1971).

In Khar lands of North Kanara District, paddy varieties such as *Kala-rata* and *Bolarata* are found to be most salt tolerant. With sandy soils of Hebbal, adjusted to different salinity levels of irrigation water, ranging from 0·3 to 10 mmhos/cm, the yield of rice progressively decreased with increasing concentration

of salts in water. Waters having E.C. more than 2–3 mmhos/cm were found quite injurious for plant growth (Perur, 1971).

Studies on Crop Quality

Indian diets are highly deficient in protein. A study was taken up to ascertain the feasibility of producing protein concentrates from indigenous leafy material. The study included the determination of the proper stage of plant growth at which maximum leaf protein was available and the ways of increasing the yield per hectare of leaf protein by suitable fertiliser application. The results indicated that the yields of dry matter of *Dolichos lab lab* L. increased with increasing levels of applied phosphorus. Protein in dry matter of leaves and also protein in leaf protein concentrate (LPC) increased, but they were not statistically significant. The quantity of protein in LPC varied from 123 to 171 kg/ha per season, which was low as compared to other conventional vegetable sources of protein such as wheat (180 kg/ha per season), or rice (180 kg/ha per season). But when compared with the leaf protein yields per hectare from vegetation processed on batch extractor, the quantity of dry leaf protein concentrates and the dry protein extracted was higher than horsegram, turnip, beetroot and cauliflower (Rao *et al.*, 1970).

Soil Fertility Under Intensive Cropping

Fertiliser responsive high yielding crop varieties have been the characteristic feature of the agricultural revolution in recent years. With the object of elucidating the multifaceted soil-crop interrelated influences of high levels of nutrients used for these crops, a study was initiated in microplots (Venkata Rao and Sadashivaiah, 1968).

Two improved varieties of ragi, *viz.*, 9–2–7 and Purna were tested for responses to 0, 40, 80, 160 lb of nitrogen application over a common dose of 40 lb P_2O_5 per acre on red sandy loams of Hebbal. Yield of both grains and straw significantly increased with increasing N levels and the response was more pronounced in case of 9–2–7 ragi. There was a trend of increased calcium content both in grain and straw wherever nitrogen was applied, but the nitrogen content remained uninfluenced. However, Purna ragi was found to contain higher percentage of N when the crop was grown with higher doses of N.

In another study, Venkata Rao and Sadashivaiah (1968) found increased nitrogen mobilisation of the order of 100 per cent through phosphate fertilisation of sannhemp (*Crotalaria juncia* L.). Their further study on the effect of application of phosphate to sunnhemp on the following crop of ragi revealed that the incremental levels of phosphorus application at the rate of 0, 40, 80, 160 and 320 lb P_2O_5 per acre increased the yields of grain and straw significantly. The yield data in respect of grain showed a linear increase of the order of 30 to 90 per cent

in respect of grain with increasing levels of applied P_2O_5. The increase in yield in regard to straw was of the order of 150 per cent. There was a significant tendency for putting out coxcomb earheads with phosphate treatments, the same being more pronounced in 9–2–7 variety. There was a change in pH with increasing levels of applied P_2O_5 (Venkata Rao and Sadashivaiah, 1969).

Incidence of jowar shootfly is a problem and has become an important factor in limiting jowar production in the State. Preliminary studies on the effect of high doses of phosphate fertiliser on the incidence of the jowar shootfly were made in the plots where the experiments on heavy application of phosphate fertilisers were conducted. Two varieties of sorghum S413 and CSH-I were grown. The results indicated that the use of phosphatic fertiliser minimised the incidence of shootfly on jowar (ChannaBasavanna *et al.*, 1969).

The influence of continuous application of high doses of nitrogen in the form of ammonium sulphate over a period of years on soil reaction and crop yields on red soils of Mysore was studied (Venkata Rao and Badiger, 1971). It was observed that there was a significant fall in soil pH from 6·5 to 4·5 in plots which received 180 kg of N per ha for five seasons The wheat crop in the fifth season as also the sunnhemp green manure crop following it, showed adverse effects of lowered soil pH as a result of continued heavy application of nitrogen fertilisers. Increasing levels of nitrogen caused a general increase in microbial population, more significantly, than that of fungi and inhibition of nitrogen fixing azotobacter. In contrast to influence of nitrogen, the incremental levels of P_2O_5 did not cause any detrimental change in soil pH and other properties. It also increased the microbial load except in case of phosphobacteria (Venkata Rao *et al.*, 1971). Based on a two-year field experimental work Halappa *et al.* (1970) found N over a basal level of P_2O_5 and K_2O as optimum level of nuirients for I-R-8 paddy.

Studies on Micronutrients

Ragi soils are under cultivation for centuries and deficiencies of micronutrients are a possibility. Studies in this behalf by Govindarajan and Gopala Rao (1950) showed appreciable increase in ragi yields to soil applications of 5 to 10 lb of zinc sulphate and the effect was more pronounced when ragi seeds were soaked in a half per cent zinc sulphate paste before sowing. Badiger *et al.* (1971) studied the availability of copper in some soils of Mysore State by Neubauer's methods. They employed various extractants to index available copper in soils. They concluded that the four extractants, *i.e*, 0·05 M, EDTA, 0·1 N HCl, Morgan's reagent and neutral normal ammonium acetate were effective. Of these, neutral normal ammonium acetate was preferred to other extractants as it gave highest correlation with uptake of copper by test plants, *viz.*, ragi.

Research Under Post-Graduate Programme

The starting of the Post-graduate Programme in 1966 leading to M.Sc. and Ph.D. in the Department gave a fillip to more concerted work on fundamental aspects of various branches in soil science. Both in the M.Sc. and Ph.D. programmes, the student is required to work on problems assigned to him and produce a thesis under the guidance of a teacher. Topics are assigned in relation to the overall research programme of the Department so as to help collection of information required to offer solution to practical problems facing the farmers. Some of the results so obtained are indicated below.

In order to ascertain the efficient method of application of different forms of nitrogenous fertilizers at different intervals, and levels, a pot culture experiment was conducted with ragi as the test crop. It was found that nitrate fertilisers were better than ammonia, and amide forms; among the nitrate carriers calcium was superior to others; application of basal dose of fertiliser in the ammoniacal form and top dressing in the nitrate proved better; and nitrate in the form of calcium ammonium nitrate had no depleting effect on soil exchangeable calcium (Vishwanath and Perur, 1971).

The persistence of systemic organo-phosphorus insecticides like phorate and diazinon applied to paddy as related to plant and soil micro-organisms and urease activity was studied by Raghurama Shetty and Perur (1971). They found that minute quantities of these insecticides were inhibitory to enzyme cholinesterase; the plant absorptions of these were gradual and their concentration at no time was above the toxic limit without any residues at harvest; the inhibitory effect on micro-organisms was only at the initial stages, the same proving beneficial at later periods, though these insecticides showed slight inhibitory effects to start with on urease activity, the same was restored to original level very soon as the plant growth proceeded and the insecticidal residue did not last beyond 100 days.

A study was conducted to correlate soil test value with leaf tissue analysis, in order to determine the optimum level and combination of major nutrients for arecanut (*Areca catechu* L.), which occupies an area of 1,35,000 hectares in the State. The soil and plant leaves were analysed for N, P, K. Ca and Mg at different intervals. Application of ammonium sulphate was found to depress soil pH and exchangeable Ca and Mg. The nutrient status of N, P and K resulting from the applied fertilisers was reflected in NPK content of the palm leaves. A significant positive correlation between available N in the surface soil and N in the first and fourth leaves was noticed. There was no significant positive correlation between exchangeable K in the sub-soil and K in the first and the fourth leaves (Bhat and Perur, 1971).

In a study undertaken to assess the influence of repeated application of high levels of phosphatic fertilisers on soil phosphorus buildup, it was found that there

was a steady and quantitative increase in the total phosphorus both in surface and subsurface soil with increasing levels of applied phosphorus Over 50 per cent of the applied phosphorus was found to have been converted into inorganic fractions, *viz.*, Al-P, Fe-P and Ca-P. Of the fractions, the Fe-P including the reductant soluble Fe-P constituted the dominant form. The phosphorus buildup showed a tendency for increasing soil moisture retention capacity, CEC, and organic matter while it did not affect the soil pH (Krishnappa and Venkata Rao, 1971).

Badnur and Venkata Rao (1971) continued the work on the influence of phosphorus buildup on physico-chemical properties of Hebbal Soil. The study indicated that phosphorus buildup significantly contributed towards improvement of water holding capacity and soil structure. There was slight decrease in bulk density. Total and available N content increased with increased levels of P_2O_5 probably due to enhanced microbial activity The phosphorus buildup tended to decrease the available zinc, copper and manganese but their level did not go below the critical limit for crop growth.

Greater leaching losses of nitrogen in lowland paddy soils has been the problem in many paddy growing areas of the State. In a study to ascertain the efficiency of some common nitrogenous fertilisers as related to form, mode and method of application under submerged field conditions on Taichung 65 variety of paddy, it was found that application of nitrogen in three equal splits gave significantly higher yields than the two splits and there were no significant differences between the two methods of irrigation; ammoniacal and amide forms were superior to nitrate; soil pH, organic carbon, available K_2O and CaO decreased after harvest, while available P_2O_5 increased with the application of nitrogenous fertilisers; leaching losses were more in nitrate fertilisers than with urea; coating fertilizers with wax and Duco-clear at 2 per cent retarded leaching losses to an extent of 16 per cent (Patil and Deshpande, 1971).

Sidramappa and Seshagiri Rao (1971) studied the mineralisation of urea in three typical soils of Mysore State, *viz* , red sandy loam, laterite and black soil at three different levels of added nitrogen, *viz* . 200. 400 and 800 ppm N under three levels of moisture, *viz.*, 40, 60 and 80 per cent of moisture holding capacity. They found that at 60 per cent moisture, ammoniacal and NO_3—N produced was maximum; transformation was most rapid in the laterite soil followed by red and black soils; rapidity of transformation increased with concentration of N level up to 400 ppm and thereafter tended to decline; urease activity was the highest in laterite soil and the least in black soil.

In order to study the manganese induced iron chlorosis in coffee (*Coffea arabica*, L.) on acidic soils of Mysore State, an experiment was conducted in nutrient solution culture under laboratory conditions on coffee seedlings. Iron was supplied as Fe-EDDHA in one series and in another, as ferrous sulphate. In both series manganese was supplied as manganese chloride. The results indicated that at

all levels of iron and manganese, there was more iron in the leaves in Fe-EDDHA series. Higher concentration of manganese caused intervienal chlorosis by interfering with the absorption and translocation of iron in the ionic form The influence of manganese and iron on chlorophyll content and the activities of catalase and peroxidase enzymes in the coffee leaves was studied. Both the chlorophyll and catalase activity were decreased by high level of manganese and low level of iron in the nutrient medium. Peroxidase activity increased with increase in the concentration of both iron and manganese in the nutrient medium (Iyengar and Seshagiri Rao, 1971).

The study of eleven profiles collected in three different regions of Bangalore District showed that the total boron content ranged from 1·4 to 17·6 ppm while available fraction was in the range of 0·054 to 0·644 ppm. The total manganese ranged from 110·0 to 617·2 ppm and active fraction varied from 6·0 to 222·0 ppm. The total zinc content was found to vary from 10·5 to 123·6 ppm and the available zinc from 0·3 to 4·25 ppm. The results indicated that the soils are adequate in respect of zinc and manganese for plant growth. Boron may become limiting under intensive cultivation. Manganese content increased with depth but zinc showed no regular pattern (Mithyantha and Perur, 1969).

The study of lime requirement of some typical acid soils of South Kanara District revealed that the rate of application of lime for such soils was about 1·3 tonnes per acre. Poor correlation existed between soil pH, lime requirement, exchangeable hydrogen and clay content. Correlation between lime requirement and organic carbon was highest. Titrimetric method of lime requirement gave better index than that of electrometric method Liming increased the yield of ragi grain and straw (Ananthanarayan and Perur, 1969).

Extension Activities

As already indicated, the Division was all along involved in the triple function of teaching, research and extension activities in the area of soils, soil fertility and fertiliser use in the State. Manurial Schedule for the various crops in the different soil climatic regions were worked out on the basis of systematic field experiments, in the several experiment stations as also trials on cultivators' fields in the different districts of the State. The schedule was embodied in a booklet and issued for the benefit of the extension workers and the farmers as early as 1920's. Several revisions of the same were issued in order to keep abreast of the fertility requirements of the continuously changing cropping patterns.

One of the important features of earlier work of the section was the close contact with the field problems through periodic visits of the staff to farmers' lands on request or on the initiative of the staff themselves to gain acquaintence with

field problems. Advice in regard to fertiliser application to different crops based on soil analysis and field inspection was a normal activity of the Division. Acidity, water logging, salinity, alkalinity and bad drainage are field problems regarding amelioration of which considerable attention has been devoted right from the inception of the Division. Several problems of soil situations were examined and specific recommendations for improving them suggested. The staff have all along actively participated in the dissemination of scientific information to farmers through radio talks, popular scientific articles in Kannada written in local daily, weekly and other papers.

Another very major and significant participation in the field service activity for the farmers is the soil testing service which was inaugurated in the State in 1956 under the sponsorship of the T.C.M. aid as a part of an All-India Project. Several hundred thousand soil samples collected by the extension agencies and sent by farmers themselves on their own initiative have been tested and individual recommendations made in respect of fertiliser application and/or their improvement. The soil testing programme operated as a part of the Division till the establishment of the University in 1965 when it got transferred to the Department of Agriculture in view of the extension nature of the activity.

The Division has also freely participated in the training programmes for extension workers and farmers organised by the Directorate of Extension besides field visits to study problem situations along with the staff of other disciplines.

Summary and Conclusions

In this paper the salient feature of the work done in the past 25 years at the Agricultural College, Hebbal, Bangalore, generally serving the agricultural needs of southern part of the State of Mysore, in the area of soils, soil fertility and fertilizer use including micronutrients and soil amelioration are briefly reviewed. The noteworthy features of the studies are the direct use of anhydrous ammonia to crops like Paddy and Sugarcane through a specially designed injector suitable for use with local ploughs and bullock-cart; phosphorus buildup in red soils through repeated heavy application of phosphatic fertilizers as a means of stabilising soil fertility; application of fertilizers for dry land crops; use of zinc sulphate to increase ragi (finger millet) yield and evolving of suitable fertility management practices for high yielding crop varieties introduced in recent years. The physico-chemical and biological changes in soil as a result of intensive cropping is a problem that needs serious attention if continued high crop yields are to be expected. Work currently in progress is directed towards this end and in addition attention is being focussed on the improvement of soil productivity of rainfed lands which constitute nearly 90 per cent of cultivated area in the State.

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Crop Improvement in Mysore : 1946–71

K. S. KRISHNA SASTRY*

ANY new agricultural technology is always built around a crop variety to exploit its maximum production potential. Never before in the history of the science of plant breeding, was there such a revolutionary change in thinking as it is today. The main reasons for this change are better understanding of other related disciplines and a more productive multidisciplinary approach.

Plant breeders have been and are continuously at work, since evolving improved varieties better than the existing ones is a continuous process. In India, organised attempts in plant breeding were started with the turn of the centry by several state departments of agriculture and with the starting of the agricultural universities in recent years, the programme has received a tremendous boost.

Before 1900, crop improvement involved selection of plants from base populations, based on the phenotype and their subsequent improvement through conscious or unconscious selection. The rediscovery of Mendelian principles in 1900, marked a new era in scientific plant breeding and led to the development of a new branch of science, the Genetics, in the field of Biology. This branch has developed tremendously in the last five decades and has thrown light on our understanding of the several facets of gene function and expression of characters in relation to environment. Today, with the knowledge of genetic principles, plant breeding is placed on scientific grounds and it is possible to tailor plants to the changing needs of mankind. More recently, with the advancement of our knowledge in physical sciences, biochemistry and molecular biology, use of physical and chemical mutagens to induce variation in a given population is resorted to extensively.

The change in thinking by plant breeders has been made possible because of a greater collaboration between related disciplines The new "plant type concept" developed on the basis of understanding of the physiology of the plant is an important achievement. The short-statured, erect-leafed, fertilizer-responsive varieties are the conforms of today. Agronomic practices and change in thinking also have created entirely new criteria for selection. Specially, research on plant population per unit area and canopy analysis, have led to new thoughts. At one time, tillering in a crop was considered an important character contributing to higher yields Now it need not be so, as any loss in yield due to lack of tillers can be made up by increasing the number of plants per unit area. Besides, the

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earhead on the main culm is better developed than the ones on the tillers. Heavy fertilizer application coupled with high seed rate, resulting in an increase in the total number of plants per unit area, has also made its tremendous impact on the plant type.

Fundamental studies in genetics, and isolation of male sterile lines, have opened up possibilities for exploiting hybrid vigour. The success in Sorghum, Maize and Bajra is mainly due to this.

Another significant change worthy of mention is that agricultural research today is not confined to national level only as it was some time ago. International agencies, and philanthropic foundations have come forward to establish international research institutes for crops, and to help in the exchange of breeding material with organised speed and introduction of new varieties breaking some national barriers.

Jowar.—In our country, research in agriculture on a planned basis started in the early years of this century through the creation of state departments of agriculture. In all the states, one of the main items of work that has been in progress is evolution of improved varieties of crops of importance in that region. In our State today, jowar is the major food crop, grown during both *kharif* and *rabi* seasons. The improved varieties evolved suited to the *kharif* season in the northern parts of the state were 340 K and further improvement resulted in D340, evolved at Dhadesagur.

These varieties were certainly improvements over the then existing varieties and were suited to Ghataprabha and Thungabhadra Project areas. In the transition tract, the varieties under cultivation were Nandyal and Fulgar varieties. In recent years, further breeding work resulted in varieties GM 2–3–1 and C–7–1195 released by the University of Agricultural Sciences, of Mysore, suited to the transition tract of Dharwar and Belguam Districts and the Thungabhadra Project area respectively. These varieties have their advantages and represent improvement over the existing varieties.

The real break through in jowar production was with the development of sorghum hybrids. Isolation of male sterile lines and suitable restorers and combiners have made the production of hybrid seed possible on a commercial scale, and it is estimated today that 40 per cent of the area under jowar in the transition tract comes under the hybrid CSH-1. The yield potential of this hybrid, about 30 quintals per acre, has had a tremendous impact on the cultivators as well as on the jowar production. This is an ideal example of scientific achievements for the benefit of mankind These hybrids, have certainly solved the problem of high yield, yet the quality preferences are to be achieved. In this regard much work is in progress and a new hybrid CSH-3 has been released A new hybrid 2219A × C.S. 3541 is very promising, with a high yield, good grain quality and fair freedom from pests and diseases (*Ann. Report UAS*, 1970–71).

The major area under jowar in the State is sown in the *rabi* season. Breeding of varieties for the *rabi* tract has been in progress since a long time. H1, a variety evolved at Hagari suited to the Hinghar tract in Bellary, having an oval compact earhead with white pearly grain, was released in 1918 (Alihyder, 1955). Some of the selections made from Maldandi types proved to be better of which M35-1 is even today the leading variety under cultivation in *rabi* season in the northern parts of Mysore This variety is reputed for its drought tolerance, its nice bold pearly grains, and good bread-making quality. Further improvement over M35-1 was achieved by crossing M35-1 with a Yennigar, selection and a new variety 7-47-3 was developed at Annigeri. This was released in 1969 by the University. (Anonymous, 1969).

The significant achievement is the isolation of male sterile line M31-2A at Siruguppa from a *rabi* variety, a Maldandi selection (Madhava Rao and Shankare Gowda, 1966). This had made it possible to obtain hybrids suitable for the *rabi* tract. Though present hybrids, CSH-1 and 2, can be grown under *rabi* conditions, they suffer from severe shootfly attack when grown during *rabi* The male sterile line evolved from a Maldandi selection when used as the base for hybrids has the advantage of being suited to *rabi* tract ideally. Several combiner lines and restorer lines have been tested. Four hybrids suited to *rabi* season are under trial. In a preliminary trial these have given yields ranging from 20 to 29 Q/ha as against 13 Q/ha. given by CSH-1 (*Ann. Report UAS* 1970–71). This suggests the immense possibilities in jowar production in the State, with the new hybrids.

Paddy.—During the early years breeding work in paddy was restricted to the indigenous tall *indica* varieties only, and the stress was more on the quality of grain particularly the non-glutionous types Many varieties selected and released were under cultivation, chief of them were S-139, S-661, S-701, S-705, SR-26 B, S-2222, (Srinivasa Murthy, 1959). Besides these, certain other varieties introduced from C R.R.I., Philippines, AICRIP, Hyderabad, also have gained ground in the State and are widely cultivated. In many parts of the State, even today a large number of varieties are grown in small pockets, like the coastal areas and rainfed northern tracts. However, in recent years with the introduction of dwarf indicas, other ponlai types, *japonica* × *indica* crosses, a considerable change in the pattern of breeding work has occurred. Extensive physiological studies have shown the importance of dwarf plants with erect leaves, the advantages being, that they are non-lodging when heavy doses of fertilizers are applied and their photosynthetic efficiency is more Associated with the plant type, importance of other characters such as photoinsensitivity, fertilizer responsiveness, have been realised. A large number of varieties have been released in recent years on All-India basis. Varieties I.R.8 , Jaya are already popular, in the State. I.R. 20 is becoming popular. As a result of work done in the University with the object of developing high yielding *cum* early maturing varieties, two varieties, namely, Suma and Kusuma were released for general cultivation in 1969.

In recent years, considerable evidence is accumulating that net assimilation rate increases with increase in sink capacity (Humphries, 1963). The major sinks in cereals at heading stage are the developing grains. Increasing the sinks is thus very useful Translocation of metabolites from vegetative parts into the grains is important for economic yield, besides the plant type. Any method to increase the net amount translocated or sink capacity has a direct bearing on economic yield. Varietal differences in sink capacity perhaps explains the great differences in yield amongst two varieties having the same plant type. Evaluation of this factor and developing a selection index for assessing this helps considerably in improving yields further.

Certain amount of vegetative growth is necessary for the complete development of the inflorescence or in other words to have the maximum number of sinks per panicle It is worthwhile examining if there is a correlation between leaf number, leaf area at a particular stage of growth (30–40 days) and the number of spikelets per panicle The importance of this in selection of types needs no stressing.

Ragi —An important food crop of the southern part of the State, grown mainly under rainfed conditions in the *kharif* season, is ragi Upto 1930, improvemen in ragi was mainly by selection and pure lining. H 22, a long duration improved variety suited to the rainfed condition, was a selection from local Madayyanagiri ragi. Similar selections of improved nature were Kl, suited to the irrigated conditions and R0786. Subsequently, by hybridization and selection, varieties like Purna, a short duration irrigated ragi, also suited to rainfed conditions and Kaveri, a long duration variety for rainfed conditions in *kharif* were evolved. (Lakshmanaiah, 1960). These two varieties are now very popular in the State and are widely cultivated. Keeping in view the nutritive aspect a protein rich white-grained variety 'Hamsa' with 9·1 per cent protein was released by the University (Mallanna and Rajashekara, 1969).

Further, intensive hybridization between varieties has resulted in a bulk of plant material showing desirable recombinants. The useful material thus developed is being screened for selection of types which are early maturing, photoinsensitive and fertilizer responsive Varieties of diverse origin like the African types which possess certain desirable characters are being combined with our cultivars. Varietal evaluation for relative drought tolerance has been made and some drought tolerant types have been identified on the basis of laboratory trial and field experiments. A simple method of inducing drought tolerance called presowing seed hardening has been developed by which plants from such treated seeds show better response to fertilizer and can withstand drought (Sastry *et al.*, 1969; Rajashekhara *et al.*, 1970).

Ragi is mainly grown under rainfed conditions during the *kharif* season, one of the factors limiting production is the light intensity. Varietal differences if any on the performance under low light intensity, needs to be determined an

exploited. Further, if varietal differences also exist in the degree of translocation of metabolites from leaves to the developing grains, this needs to be exploited too. In a few varieties of ragi, the contribution of the earhead to the filling of grain was prevented and the decrease in earhead weight was found to range from 13 to 33 per cent and 9 to 26 per cent In such varieties where the decrease in earhead weight is the least, the translocation from other parts, particularly leaves must have contributed more for grain development This method gives indirectly the extent of translocation A variety in which greater translocation occurs is thus better suited to the *kharif* season, when light intensity is limiting and earhead contribution is low

Mutation breeding has resulted in the isolation of certain dwarf mutants obtained from our standard varieties and these are under further evaluation. Aneuploid lines in ragi have been developed in EMS-treated material in the variety CO1. Presently, plants having chromosome number ranging from 36–42 have been isolated of which four are trisomics. This helps in understanding the location of genes on the different chromosomes. This work is being carried out in the cytogenetics section

Development of an ideal plant type in ragi is necessary to achieve a break through in production. Based on the observations in paddy, wheat and the wide variability present in ragi, a plant type having the following characteristics may be an ideal one:

1. Dwarf habit.
2. Leaf orientation at about 45°.
3 Non-tillering mono-culm.
4. Fertilizer responsiveness
5 Photo insensitivity.
6. Large grain bearing area

In this, an explanation for suggesting a mono-culm type may not be out of place. The earhead developed on the main culm is always bigger than the ones on the tillers. Whatever yield reduction there may be in using a non-tillering type, may be made up by increasing the plant population of the mono-culm type per unit area Further in a mono-culm type of plant, the available root system has to feed nutrients and water to only single shoot in contrast to the tillering plant, where the root system is not proportionately increased

Cotton.—Though cotton is grown in India over 8 million hectares, imports of superior long staple cottons capable of spinning 60's cost the country about Rs 85 crores annually. In a situation such as this it is the breeder who can, by evolving types which can satisfy the requirements, save the drain on foreign exchange. A brief account of work in this direction is given below.

In Mysore two species of cotton are widely cultivated, *Gossypium herbaceum* and *G. hirsutum*. Recently many varieties of the species *G. barbadense* are introduced and are under cultivation.

In *G. herbaceum* variety W1 suited to the western tract comprising of Bellary District and parts of Chitradurga was evolved at Hagari and was superior to the then existing H-25 (Rao, 1956). In Karnatak area a strain Jayadhar, released in 1947 is quite popular still (Kaiwar, 1956) and S-69 was widely grown in Davanagere, Chitradurga and Tumkur Districts. More recently a variety suited to Raichur and Gulbarga Districts called Raichur-51 has been released. This variety has given an increased yield of 10·3 per cent and has increased ginning out turn of 11 per cent over the Westerns-1. Other selections like EPSB and DBSB are under trial and have given increased lint yield ranging from 28 to 48 per cent over Jayadhar.

Amongst the hirsutums, new varieties have replaced the old Laxmi, which was a selection from a cross between Gadag No. 1 × Co. 2, and released in 1947. Amongst these new varieties, Hampi, released for cultivation under irrigated conditions in TBP area is quite popular and is occupying large area.

Mysore Vijaya released by the University is superior to 170 Co. 2 in many ways and is recommended for cultivation in the Ghataprabha Project area.

Another significant achievement has been the successful exploitation of hybrid vigour in cotton A new hybrid called 'Varalaxmi' an interspecific hybrid between *G. hirsutum* cv Laxmi × *G. barbadense* cv SB-289-E, has shown great promise. Since this hybrid has *G. barbadense* as one of its parents it has the good fibre qualities incorporated into the hybrid. Varalakshmi has yielded 36 per cent over Lakshmi a ruling variety and 30 per cent over Hybrid-4, besides possessing good fibre qualities (Katarki, 1971).

A new trend in breeding of varieties in cotton is in developing determinate types. The problems of continuous growth under favourable conditions particularly under irrigation, are many including management, boll shedding, and plant protection and picking 2 or 3 times. Determinate types, would eliminate some of these problems. A few, such types are under trial and suitable agronomic practices to exploit the potentialities of these are to be determined.

Problems relating to drought, physiological boll shedding, boll load per plant under a given fertility level, need to be worked out.

Pulses.—"Rice and wheat have been two of our most intensively investigated crop plants, but inspite of a long history of research, it was found necessary in recent years to give them a completely new frame to improve their productivity. A change in plant type can be even more rewarding in crops like pulses." (Jain, 1971). In this paper he suggests what the plant type in pulses ought to be

i) Reduction in bushy growth habit. (ii) Improvement in harvest index(weight of grains/total plant weight). (iii) Reduced maturity duration.

Attention is being diverted to this group of crops in recent years. It has now been possible to have a germ plasm collection of the different pulses. In Mysore also, at RRS, Raichur, collections of pigeon, pea, black gram, green gram, cowpea, and other pulses have been built up. Some selections which are early maturing, have been made from the germ plasm in pigeon pea, black gram and green gram and are under multilocation trial. Of these cultures, 5039 and 2635 in pigeon pea are showing promise as they are 15–20 days early and their yields are at par with C 28 control.

A variety of green gram T51 has given higher yields than China Mung in multilocation trials conducted in two seasons. (*Ann. Report of UAS* 1970–71). As a result of work done earlier at Annigeri on bengal gram a new variety of gram Annigeri Kadale No. 1 has been released which is high yielding and tolerant to wilt.

In field beans, avare, crosses have been made between *Dolichos lab lab* variety *lignosus* and variety *typicus* and some of the recombinants show early maturity. A bushy type and non-season boundness Selection for pod borer resistance is also in progress.

Oilseeds.—A break through in oilseed production is yet to be achieved, though some improvement has been made by evolution of new high yielding varieties. In groundnut, two varieties a bunch type S-206 and a spreading type S-230 have been released for general cultivation by the University. Before this, two bunch strains developed at Hebbal designated as *HG 8* and *HG10* were released during the early 1950's (Gopala Iyengar, 1956). S-206 has been found to be drought tolerant in the laboratory tests and is also found to be a high yielder in all-India co-ordinated trials under rainfed conditions. Another selection Hippargi 2–21 was better than S-206 and is also early by 8–10 days (*Ann. Report, UAS*, 1970–71).

In the bunch types, profuse branching is associated with high pod formation and this might serve as a good index for selection. Besides, types which flower early and have a higher percentage of pod formation are certainly disirable. Another important breeding objective is breeding for tikka resistance. None of the varieties in the cultivated species seems to possess any resistance to this disease. In this regard transfer of alien genes from wild species needs to be done. Many of the diploid wild species have high degree of resistance to this disease. Recent cytogenetical studies have shown that one genome is common between these wild and cultivated species. Employment of suitable techniques for interspecific hybridization followed by repeated back-crossing with the cultivated species or irradiation of the F, may help in the transfer of resistance to tikka (Seetharam *et al.*, 1971).

In castor, attempts are being made to evolve varieties with 100 per cent pistillate flowers to examine possibilities of using these as parents to exploit hybrid vigour. Attempts to evolve hybrids by isolating good combiners, would be worthwhile. A few types which have 95% pistillate flowers have already been isolated and the combining ability of some of these are being tested An early maturing, dwarf type evolved at Rajendranagar, NPHI-Aruna has become quite popular and is widely cultivated in Mysore.

Safflower.—Safflower is grown as a mixed crop mostly, in the northern parts of the State; Research on safflower during the early years has resulted in the evolving of the variety A-300. Further improvement has resulted in the production of the variety 7-13-3 which yields 20–25 per cent more than with the same oil content. This variety has been released by the University.

Wheat—Wheat production in our country has been revolutionised by the introduction of the dwarf, fertilizer-responsive genotypes possessing the new plant type. The green revolution in the country is mainly attributed to this. Varieties like Kalyansona, Sherabati sonara, are widely grown and are responsible for doubling wheat production in the north in less than 4 or 5 seasons.

Durum wheats are grown over a fairly large area in the Deccan. This is mainly a *rabi* season crop. No high yielding varieties, comparably to those evolved in aestivums, have been evolved in durum wheats. As a result of breeding work done at Bijapur two varieties Bijaga yellow and Bijaga red were released for cultivation. Of these, Bijaga yellow has been found to perform well under rainfed conditions and has ranked first amongst several durum varieties tested in the Deccan. This variety is also resistant to many races of rust occurring in the South except race 42B. This variety is popular in the State and widely grown (Murabad *et al.*, 1968). Development of high yielding types, in durum wheats should receive immediate attention of breeders. Study of germ plasm of durums, has shown that there are a few genotypes with the desirable plant type. This can be used as breeding stock. Two main problems in durum wheats are drought tolerance and disease resistance. Hybridization between strains of durum having the desirable plant type and a variety like Bijaga yellow may result in better suited and more productive varieties.

An attempt has been made to briefly narrate the achievements in some of the major crops in the State. Breeding work is also in progress in several other crops like minor millets, sugarcane, tobacco, other oilseeds and pulses.

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Plant Pathology-Problems and Progress in Mysore: 1946-71

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PLANT Pathology like other discipline in Agriculture has made rapid strides during the past few decades. New techniques, technological tools and ever-increasing spirit of enquiry have considerably contributed to the proper understanding of plant disease concepts. The knowledge of biochemical changes in the suscept, physiologic specialization in pathogens, genetic manipulation in building up host resistance and development of systemic fungicides and antibiotics have opened up a new era in plant disease control During this ominous period of phenomenal change and hectic scientific pursuit around the corner, Agriculture College, Hebbal, came into existence, 25 years ago.

This period of 25 years has been quite exciting and eventful for the Department of Plant Pathology at this Institution. It must be conceded, however, that this department was singularly fortunate in having a good start for its activities since the firm foundations had already been laid by such stalwarts in the field like Dr. Leslie C. Coleman, Dr. M. K. Venkata Rao and Mr. M. J. Narasimhan to mention only a few. It was as early as the beginning of this century and upto early twenties, this group of devoted workers had already identified the major problems such as *Koleroga* of arecanut and coffee, coffee leaf rust, *Ganoderma* on coconut and arecanut, brown rot of potatoes, sandal spike and a host of other economically important diseases. Their meticulous observations and accurate recordings, including evolving of suitable control measures for many of them are even today standard work of reference to the present and future workers in the field. The herbarium and reprint collections that they and the subsequent Pathologists, who succeeded them, *viz.*, Mr. S. V. Venkatarayan and Mr. N. S. Venkatakrishnaiah, built and the Sectional Library that they organised, stand testimoney to their devotion to work and as a source of inspiration to the posterity.

The Section, located at the Department of Agriculture at that time, consisted of a meagre component of staff completely devoted to the sole objective of solving the burning problems in the field of Plant Pathology. To keep up the tempo of the work that they had inherited in the division was a challenge to the later workers in the field. If whatever little that has been achieved during the past 25 years under review in this branch of science at this Institution, is largely due to the strong foundation laid by these pioneers which served as a spring board for further development and activities.

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With the starting of the College in 1946, the subject of Plant Pathology was taught in the final year in the three-year degree course. There was no separate staff exclusively for teaching and as such the Head of the Department used to handle classes in the capacity of *ex-officio* Professor. This set-up continued up to the time the University came into existence, when full time teaching staff was appointed. The sectional staff at that time in the Department of Plant Pathology had a triple function to perform namely Teaching, Research and Extension activity all combined in the individual. In the field of research, many notable contributions were made. These contributions included basic as well as applied research in the fields of Systematic Mycology and Botany, Plant Pathology, Virology, Nematology and Bacteriology. In the field of teaching, the programme included mostly the undergraduate training in the traditional system until the time University took over. The post-graduate programme in Plant Pathology was started in 1966 and presently both the under-graduate and post-graduate programme are under the trimester pattern.

During the period of 25 years of development, systematic Botany and systematic Mycology progressed in a methodical manner These areas of specialisation in Botany and Mycology, which were more or less neglected, made great strides. In the field of systematic Botany, large collections of plant specimens, especially weeds including grasses and sedges, were made in the State and studied with a view to identify and classify them and finally to deposit them in a Herbarium for future reference work (De Souza, 1956; Govindu, 1951; Govindu and Panchal, 1970; Govindu and Thirumalachar, 1949, 1952, 1960; Panchal *et al.*, 1964–65). These studies have greatly facilitated the identification of hosts that are parasitised by fungi. Many of these collections are now housed in Herbarium located in the Botany Department of Agricultural College, Hebbal.

Likewise, a well authenticated Mycological Herbarium is also maintained in this Department. At present there are nearly 2,000 collections of fungi representing 200 genera. The Herbarium includes several type specimens. A large collection of smuts, rusts and the genus *Cercospora* are available for study. All the collections have been catalogued in the Herbarium register and index cards for both hosts and fungi are also maintained.

In field of systematic mycology, several new fungi were recorded, including recording of monographic work of certain genera and groups of fungi. Perhaps the most comprehensive work in this area was the monographic studies of *Cercospora, Ephelis* and *Balansia.* Nearly 80 new species of *Cercospora* from India, which is a cosmopolitan fungus with a very wide host range, was described. There were some 80 new host records for India reported for the same fungus. Several other species were recorded as new distribution to India. This monographic work was published as series of papers in *Sydowia* (Austria) (Thirumalachar and Govindu, 1953 *a*, 1953 *b*, 1954 *a*, 1956, 1963; Govindu and Thirumalachar, 1954 *a*, 1955, 1956, 1965: and Govindu *et al.*, 1971). Govindu and Thirumalachar

(1963 *b*) published a check list of *Cercospora* in India in which they included 451 species of *Cercospora*, on 508 hosts of which 19 species are excluded and reference to them is also cited. On 29 hosts, the *Cercospora* have not been identified upto the species The authors also listed the original citation with respect to each species and also brought up-to-date citing of correct names of the several hosts which are suscepts for *Cercospora* species in India Similar monographic studies were made in *Ephelis* and *Balansia*. While Venkatakrishnaiah (1946 *a*) reported *Ephelis* on two new hosts and later (1952 *a*) on two more hosts, the monographic work on *Ephelis* was actually done by Govindu and Thirumalachar (1954 *b*, 1961, 1963 *a*) These studies were most comprehensive as far as the genus is concerned for the tropics and included detailed investigation on morphology and taxonomy Govindu and Thirumalachar (1961) examined 21 species of grasses parasitised by *Ephelis* and for the first time a detailed account on the characteristics of the fungus, relationship of *Ephelis* with its ascigerous stage *Balansia*, were given. These studies were followed by monographic work on species of *Balansia* (Govindu and Thirumalachar, 1963 *a*). They were the first to make very critical and exhaustive studies which included host symptoms, life-history and taxonomy of tropical species of *Balansia* and its relationship with the conidial stage *Ephelis*. Govindu (1969) reported *Ephelis* on a high yielding variety of paddy IR-8 and cotton grass.

Apart from these monographic studies, several mycological papers were published and these have added to additional knowledge of the different fungi that have already been described. An interesting case of a fungus parasitizing another fungus was reported in Bangalore (Venkatarayan, 1946 *b*). He found profuse development of powdery mildew, *Leveillula taurica* (Lev), Arnaud, on the cultivated cluster bean (*Cyamopsis psoralioides* DC). On examination, he found also groups of pycnidia of the parasitic fungus *Cicinnobolus cesatii* de Bary. This record of its occurrence on *L. taurica* has not been reported earlier in India. Venkatakrishnaiah (1946 *b*) cultured *Sclerotium rolfsii* Sacc., from *Musa sapientum* Linn., the cause of pseudostem rot in plantains He also obtained the perfect stage and identified the fungus as *Corticium rolfsii* Curzi. Govindu (1949) reported the occurrence of *Cerebella* species closely agreeing with the descriptions of *Cerebella andropogonis* Cesati. It was found to inhibit sclerotial development of *Claviceps* on sugarcane and convert them into greenish-black cerebriform stromata. The *Cerebella* was noticed to be making saprophytic growth on the sphacelial stage of the sugarcane ergot, partially suppressing the sclerotial stage that would follow in normal development. An interesting smut producing galls on the rhachis of the inflorescence was reported by Venkatarayan and Delvi (1951 *a*). The report of this smut, *Ustilago crusgalli* Tracy and Earle was recorded on *Echinochloa colonum* Link., a common weed and fodder grass on bunds in paddy fields. Venkatakrishnaiah (1950) found *Phytophthora parasitica* Dast., parasitising French bean (*Phaseolus vulgaris* Linn.) for the first time in Bangalore One per cent Boardeaux was recommended for control of the disease. Venkatarayan and

Delvi (1951 *b*) observed for the first time in India *Aspergillus niger* Van Tiegh., on onion. Govindu (1952) reported *Tilletia transvaalensis* Zundel on *Eragrostis tenuifolia* Hochst , a very common grass in dry locality in Hebbal This report is of interest since very few species of *Tilletia* are known to occur in South India as compared with the number known to North India. Venkatakrishnaiah (1952 *b*) observed that the guava canker is associated with *Colletotrichum psidii* Curzi and *Pestalotia psidii* Pat. He also obtained the perfect stage of *Colletotrichum psidii* [*Glomerella psidii* (Del.) Sheldur] in pure culture Cross inoculation experiments were carried out and he found that the former can infect the fruits of apples, chilly, lemon, papaya, plantain, mango and tomato while the latter did not infect any of these. However, both the fungi infected the leaves and fruits of guava One per cent Bordeaux application was recommended for control of this disease. Flowers and leaves of *Amaranthus paniculatus* Linn were observed to be blighted by a species of *Alternaria*. The fungus was identical with *Macrosporium amaranthi* Peck, reported on *Amaranthus retroflexus* Linn , from Kansas. The name *Alternaria amaranthi* (Peck.) Comb. nov., was proposed for the fungus (Venkatakrishnaiah, 1952 *c*). Venkatarayan and Venkatakrishnaiah (1953) reported the downy mildew of cucurbits *Pseudoperonospora cubensis* (Berk. and Curt.) Rostor , on three new hosts, *Cucumis sativus* Linn., *Lagenaria vulgaris* Ser , and *Citrullus vulgaris* Schard., all belonging to Cucurbitaceae The leaves of *Solanum torvum* Swartz , was found to be heavily infected by the powdery mildew *Leveillula taurica*. This was the first record of the fungus on this host (Venkatarayan, 1953). Thirumalachar and Govindu (1954 *b*) described a new species of *Endophyllum* (*E. spilanthes* Thirum. and Govindu) parasitising *Spilanthes acmella* Linn. This rust was reported to have only telioid aecia in association with abortive or undeveloped pycnia. The cytological studies of this bisporidial rust indicated that the two nuclei in the telioid aeciospore do not fuse and on germination undergo single conjugate division forming a two-celled promycelium. The basidiospores are binucleate and are basidially bisporous or miktohaplontic Venkatakrishnaiah (1957–58) reported the occurrence of soft rot of ginger caused mainly by *Pythium* and occasionally by *Fusarium* He recommended control measures which included cultural practices along with the use of chestnut compound. He also suggested the treatment of the rhizomes with organic mercurials Venkatakrishnaiah (1960) recorded stray attacks of onion smut, *Urocystis colchici* (Schlecht) Rabenh , on onion and garlic from Mysore. This report was of interest, since the presence of this disease on onion jeopardised the export trade and hence numerous steps had to be taken up to erradicate the disease and to prevent its spread With a view to study these various aspects, intensive investigations were taken up in the Plant Pathology Department. Urs *et al.* (1963) published a comprehensive report on the present status of the smut in India and its control The authors (*loc. cit.*) found that this smut was known to occur on localised areas on onion only. The authors recommended the following measures to check the spread of the disease. (*a*) Declaring the area of the infested fields under the Pests and Diseases Act of the State; (*b*) Not to allow export of onion from the areas declared as in (*a*); (*c*) Not to permit culti-

vation of onion in infected fields for about 6 years in the first instance, and (*d*) to allow planting of the area only with onion seeds pelletised. Of the four fungicides tried for control of onion smut (Thiram, Arasan, Flit 406 and PCNB), Thiram was found to be superior than others. The seeds were pelletised with tenac 1: 1000 ml. which was found to give complete coating on the entire surface of the seed. The detailed method of pellatising seed is described in this paper.

Govindu (1962) presented a paper on some of the major pests and diseases of important agricultural crops in India at the International Plant Protection Seminar held in W. Germany.

In the course of study of several varieties of *Crotalaria juncea* Linn., Kempanna *et al.* (1960) noticed a wilt disease at Hebbal. This wilt was identified as due to *Colletotrichum curvatum* Briant and Martin and was reported as first record on this host from Mysore State. The annual recurrence of late blight of potato incited by *Phytophthora infestans* (Mont) de Bary in the plains on N. India has been a subject of study by several investigators. A brief survey of potato crop in several parts of the State in 1961 showed stray cases of late blight-affected crop in Bangalore District (Govindu, 1961) There was no previous record of this fungus in the Mysore plains prior to 1961. Narasimhan *et al.* (1963) described a new smut genus, *Georgefischeria* in honour of George W Fischer a very eminent investigator on smut fungi. This monotypic species *G. riveae* Thirum. & Naras., is unique, since it combines sorus character of *Melanopsichium* and the spore characters of *Entyloma.* Further, the development of sori of this smut in lysigenous cavities with the spore mass embedded in gelatinous matrix has not been reported in the Tilletiaceae. The character of the spore in being thin-walled, hyaline and germinating by a whorl of sporidia is as in the case of *Entyloma.* This smut was found to incite witchesbroom-like malformations of axillary shoots on *Rivea hypocrataeriformis* Chois. The type was collected in Poona. Later, the same smut has been known to occur on another convolvulaceous host, *Argyreia* species, from Nandi, Mysore State. *Verticillium albo-atrum* Reinke and Berth, a destructive wilt pathogen reported to attack on nearly 300 cultivated plants, was reported on *Pyrethrum cinerarifolium* Treu. (Shivanandappa and Govindu, 1965). This report is of interest since no *Verticillium* species is known on *Pyrethrum* in India and therefore care should be exercised in preventing the spread of the disease, if large cultivation of *Pyrethrum* is to be undertaken Later in 1969, Ranganathaiah and Swamy reported the same wilt organism on *Pelargonium graveolens* (Linn.) Heritt, the plant which yields oil used in soaps, perfumery and cosmetic industries. This record also was the first report of the fungus on a new host. Another wilt disease caused by *Sclerotium rolfsii* Sacc., was recorded on *Jasminum sambac* Ait., by Shivanandappa and Govindu (1966). This wilt was the first report on *J. sambac* from India. Rajendran (1965) reported the perfect stage of powdery mildew *Erysiphe cichoracearum* DC., on bottle-gourd (*Lagenaria vulgaris*) for the first time in Mysore. The appearance of perfect stage of this powdery mildew on cucurbits

is a rarity and it was not reported earlier from Mysore. Shetty and Lucy (1966) reported a new leaf spot disease *Pleiochaeta cassiae* Govindu, Shetty and Lucy on the leaves of *Cassia sumatrana* Linn., a common avenue tree. This was the first record of the fungus on the host. Nagaraj and Govindu (1969) gave a detailed account of several interesting fungi from Mysore. This report included some new records of rare fungi and also occurrence of two new species, namely *Penicilliopsis bambusae* Nagaraj & Govindu on *Bambusa* sp. [in association with sphacelial stage of an unknown fungus (*Claviceps*?)] and *Sphaerulina trapabispinosae* Nagaraj & Govindu on *Trapa bispinosa* Roxb.

Yenni (1970) studied nature of resistance and physiological changes associated with tikka disease of groundnut. These studies revealed that in the resistant variety under healthy condition, there was more peroxidase activity, less dehydrogenase activity, more reducing sugars, lower sap pH, more chlorophyll content and more riboflavin as compared to the susceptible healthy tissues.

Diseases of fruits and vegetables in transit and storage have not received any serious consideration in India except for a few isolated records of fungi. This aspect of study was initiated in 1968, when Hiremath isolated and studied from the diseased vegetables of Bangalore markets, 26 species of fungal pathogens, belonging to 11 genera causing 55 diseases on 20 different hosts. Of these 55 diseases, 12 of them were of field origin, while the remaining 43 wound parasites. The most frequent pathogen was *Aspergillus niger* van Tiegh., followed by *Fusarium oxysporum* Schl., and *Alternaria tenuis* Auct. Except, *Aspergillus niger* on onion, all the pathogens causing different diseases are new records for Mysore State.

Studies on insect pathology was initiated in 1965. Urs *et al.* (1965, 1967) and Urs and Govindu (1971) made exhaustive studies on the two entomogenous fungi *Beauvaria* and *Metarrhyzium*. Urs. *et al.* (1965) reported a preliminary study of white muscardine fungus *B. bassiana* (Bals.) Veill.. on cabbage semilooper. In their studies, Urs. *et al.* (1967) made an attempt in the laboratory to study the effect of normally recommended and high concentrations of certain common insecticides on the development of *B. bassiana* and *M. anisopliae* (Metsch.) Sorok., with a view to ascertain the possible use of some of these micro-organisms individually or in combination with sublethal doses of insecticide for control of certain insect pests by an integrated approach. Results of these studies indicated that out of six insecticides tried on the two fungi under laboratory conditions, BHC 50 per cent WP was the most toxic while Dimecron 100% was the most innocuous. The other insecticides, Folidol, DDT, Malathion and Endrin had different effects on the growth and sporulations of the fungi, and the two fungi also reacted differently to the same insecticide. *M. anisopliae* could be readily cultured in quantity on a medium containing honey, peptone and barley. *Poecilocerus pictus* and *Heliothis obsoleta* are two additional hosts of the fungus reported for the first time (Urs and Govindu, 1971).

In recent years, even though integrated control is one of the approaches for successful combating of a pest and/or a disease, chemical control still is largely

practised. *In vitro* studies of the chemicals provide information confirming fungi toxicity against specific pathogen and, therefore, serve as a reliable basis for field testing. Several such studies have been in progress in the department Out of seven fungicides used against *Helminthosporium oryzae* Breda de Haan and *H carbonum* Ullstrup to test their efficacy *in vitro*, Captan gave the maximum inhibition followed by Breston and Duter. Brassicol inhibited the two species only at the higher concentrations tested. Nickel chloride, Dithane Z-78 and blue copper were ineffective (Shivanandappa *et al.*, 1968). Hegde and Shivanandappa (1968) made laboratory studies on the evaluation of 8 fungicides and one antibiotic on *H. nodulosum* Berk. and Curt. They concluded chemical concentrations and their interactions are highly significant. In their recent studies, Shivanandappa *et al* (1971) tested three concentrations of eight fungicides *in vitro* against seven isolates of *Sclerotium* obtained from paddy, ragi, sugarcane, banana, barley, wheat and jasmine for their growth-inhibiting efficacy. Vitavax was found to be the best followed by PCNB *Sclerotium* isolate from paddy was very sensitive to chemicals and was inhibited by all fungicides tried even at the lowest concentration, while the wheat isolate was effectively inhibited by Vitavax only Hegde *et al.* (1969), studying three fungicides with four concentrations, tested them *in vitro* against eight plant pathogenic fungi Captan was found effective against all pathogens. Both Breston and Duter were ineffective against *Fusarium moniliforme*, Sheldon.. *Pestalotia menezesiana* Bres. and Torrend., and *Phytophthora infestans* were inhibited by higher concentrations of Breston and Duter respectively. Captan was specific to *Alternaria brassicae* (Berk.) Sacc., Breston to *P infestans* and *Gloeosporium ampelophagum* (Pass.) Sacc., and Duter to *A. tenuis* Auct., and *Colletotrichum coffeanum* Noack.

Lucy and Delvi (1966) studied the effect of seed treatment on the germination of seeds during storage in respect of externally seed-borne diseases, *viz Sphacelotheca sorghi* (Link.) Clinton and *Helminthosporium nodulosum* of jowar and ragi respectively. Aresan, Tillex dry, and Ceresan dry at 0·2 per cent by weight were found almost uniformly effective in case of jowar whereas in case of ragi Agrosan G.N. at 0·2 per cent by weight efficiently preserved the viability even after one year.

Ragi [*Eleusine coracana* (Linn.) Gaertn.] has perhaps received the maximum attention in recent years in regard to study of its diseases, since it happens to be the most common and extensively cultivated dryland crop in Mysore contributing to 34·5 per cent of India's ragi production. Some preliminary studies were made earlier by Venkatakrishnaiah (1954) and Venkatarayan (1946 *c*, 1950). However, exhaustive studies were taken up only in 1966, the year when an epiphytotic of devastating disease of ragi broke out in Mysore and neighbouring States and practically wiped out the summer crop (Govindu and Shivanandappa 1967). This outbreak was reported as having been caused by a disease-complex involving a virus and fungus. The studies of virus component of the disease-complex is dealt with separately under investigations on virus diseases. Earlier, Govindu *et al.* (1966)

and Govindu and Swamy (1966) screened the Indian collections of *Eleusine* to a *Pellicularia rolfsii* (Sacc.) West., Nematode disease-complex From these studies, they classified the 793 Indian varieties as, resistant: 322, intermediates· 239 and susceptible. 232. The collections from Mysore, Tamil Nadu and Andhra Pradesh were the most resistant as a group. Govindu *et al.* (1970 *b*) made detailed observations on diseases of ragi with special reference to host resistance to the *Helminthosporium* disease. In their studies (*loc. cit.*, 1970 *b*) 806 varieties were tested in the field for reaction to the *Helminthosporium* disease The varieties were classified as resistant: 139, moderately resistant: 359 and susceptible: 308 The ragi collections from Mysore (39) Africa (38), and Tamil Nadu (34) had high percentages of the varieties that were resistant. Recently, Govindu *et al.* (1971 *a*) studied the reaction of world collection of ragi to blast disease. Of the 488 world collections screened, none were reported to be resistant, 153 moderately resistant, 190 moderately susceptible and 145 susceptible. African collections stood first in showing moderate resistant reaction. Tamil Nadu, Mysore and Orissa collections showed highest number of combined moderate resistance to blast, resistance to *Helminthosporiose* and *Sclerotium*-wilt.

Studies on biology of ragi smut, caused by *Melanopsichium eleusinis* (Kulk.) Mundk. and Thirum., was carried out (Ganapathi, 1971). A new type of symptom hitherto not reported was described Inoculation studies have revealed that the infection takes place at an early stage of flowering by the air-borne sporidia. Studies on teliospore germination and cultural characters of monosporic isolates indicated the possible existence of physiologic races of the pathogen The best medium for sporidial culture has been established.

Kempanna and Govindu (1969 *a*) studied pattern of phenotypic variations in African collections of ragi. These studies revealed the existence of a considerable amount of variation with regard to plant habit, duration, structure and composition of the earhead and glume and grain colour Based on structure and composition of the earhead metrics. a total of 21 types were recognised and detailed description of each of these types have been described. Continuing the same work on 541 Indian collections of ragi, Kempanna and Govindu (1969 *b*) broadly classified them into 12 main earhead types and several sub-types. Description of each type is also given.

Paddy is one of other crops, which has received considerable attention as far as its diseases and control aspects are concerned. In recent years, research is concentrated mostly on fungicidal and antibiotics trials as well as screening of world collections to various diseases. To study the efficacy of antibiotics against blast of paddy, trials were conducted during 1966, 1967 and 1968 on the Main Research Farm, Hebbal. which is one of the blast endemic areas in the State. A highly blast susceptible variety S317 was used. Three antibiotics, *viz.*, Kasumin liquid E C. (1 ml. in a litre of water), Bla–S (1 g in a litre of water) and Aureofungin W.P. (1 g in 45 litres of water) were used. All the three antibiotics reduced incidence of the disease and increased the yield in varying degrees (Hegde, 1971). 1,195

varieties of paddy were screened for blast resistance at seedling stage following the standard uniform blast nursery technique during 1967 in Ponnampet, one of the endemic areas for blast in Mysore State (Shivanandappa and Govindu, 1969). Out of 1,195 varieties, 10 varieties were found to be resistant, 27 moderately resistant, 58 moderately susceptible and the remaining 1,100 varieties susceptible to the disease. The 10 resistant varieties were found to be resistant at earhead stage also.

With the introduction of high yielding varieties of maize and other millets downy mildews are assuming serious proportions warranting immediate attention. Govindu *et al.* (1970 *a*) have worked out the detailed morphology of the maize downy mildew organism as occurring in Mysore and identified it as *Sclerospora andropogonis sorghi* (Kulk.) Kulk., being recorded for the first time in Mysore State. Several maize varieties have been screened against this mildew and a few promising lines have been identified. In another study on downy mildew of sorghum, it has been shown that oospores adhering to the surface of the seed play an important role in initiating primary infection (Govindu, 1971). Studies on maize rust indicated that initial dark exposer of maize plants inoculated with the uredospores upto 12 hr had no effect on the germination of uredospores and appressorial formation (Kushalappa and Hegde, 1970 *a*). Varietal screening of maize indicated that the severity varied from 80 per cent in hybrids to nil on variety Cuzco. The severity of rust infection also varied at different stages of plant growth (Kushalappa and Hegde, 1970 *b*).

Diseases of jowar (*Sorghum vulgare* Linn.) especially caused by smuts in recent years have received considerable attention. Studies on grain smut of jowar caused by *Sphaecelotheca sorghi* have indicated the presence of variation in types of sori, varietal reaction and cultural characteristics of monosporic isolates obtained from smuts of different localities (Ranganathaiah and Govindu. 1970; Ranganathaiah, 1969). Infection studies have shown that the germ tubes enter through the mesocotyl region and the susceptibility remained for a short period of 5–7 days after the seed germination. Extract from 400 g of potato, 20 g of dextrose. 20 g of malt extract and 1 g of peptone in a litre of water was found to be the most suited combination for the mycelial growth and sporidial production in culture. Possible occurrence of physiologic races of the pathogen was demonstrated based on symptoms, cultural characteristics and host specialisation. Teliospore germination studies of head smut of jowar caused by *Sphaecelotheca reiliana* (Kuehn.) Clinton have revealed that in 2 per cent malt extract at 35° C, maximum spore germination occurs. Types of spore germination, cultural and physiologic characters of sporidial cultures were studied (Padaganur, 1969) 12 varieties commonly grown in the State were screened for their resistance. Monosporic isolates obtained from two distinct types of symptoms were found to differ in their cultural characters, indicating the possible occurrence of physiologic races of the pathogen (Padaganur and Govindu, 1971).

In the field of Virology, Coleman (1917, 1923) was the earliest worker to study the spike disease of sandal, followed by Narasimhan (1928) who for the first time

noticed the occurrence of intra-cellular bodies. Later, Narasimhan (1933) made further detailed cytological investigations on sandal spike disease. Venkatarayan (1946 *a*) described a new mosaic disease of ragi in Mysore. He reported that it appeared during June–July, 1946 and was preceded by dry conditions due to failure of monsoon in 1945. However, he did not prove the causal nature of the disease. In the following year (1947), he described another mosaic disease on common weed plant, *Malvastrum coramandalianum* (Linn.) Garcke. He described the symptoms of the disease and suggested that this weed might be acting as an alternate host for the bhendi yellow vein mosaic virus. Except for these studies (especially on sandal spike disease which is now proved to be of mycoplasma nature) Virology did not receive much attention until Govindu (1964) made a critical review at the instance of I.C A.R., New Delhi, on the virus diseases of crop plants of South India. In this review, he mentioned about the occurrence and the importance of some of the virus diseases like, mosaic and grassy shoot of sugar cane, Katte disease of cardamum, mosaic and bunchy top of banana, TMV and leaf curl of tobacco, viruses of potato and citrus plants and emphasised the urgent need for starting the virus research laboratory in Mysore State. Yaraguntaiah and Govindu (1964) reported the occurrence of yellow mosaic of *Dolichos lab lab* Linn., in Mysore for the first time and showed that the virus was transmissible by grafting and through white-fly, *Bemisia tabaci* but not by sap or seed or through certain aphids tested and through another species of white-fly, *Siphonimus finitimus*.

The possible occurrence of tungro and yellow-drawf viruses on rice in Mysore State was reported by Govindu *et al.* (1968). They described about the symptoms of these diseases under field conditions and stated that they had noticed about 30 per cent infection especially on rice variety IR–8–178–3–1 and stray infection on ADT–27 grown in the nearby rice plots at Hebbal, Bangalore. Further, they reported that insect vectors of these diseases were present in abundance in the suspected diseased rice plots.

Critical and exhaustive studies on ragi virus was initiated in 1967 (Govindu and Shivanandappa, 1967). Continuing the work, Yaraguntaiah and Keshavamurthy (1969) and Keshavamurthy and Yaraguntaiah (1969) established the insect vectors for the virus component of the ragi disease complex for the first time from this department, and showed that the virus was transmissible by fulgorid insect, *Sogatella longifurcifera, Cicadulina bipunctella* and *C. chinai* experimentally obtaining 8–10 per cent through fulgorid insect and 60–80 per cent transmission through other two species, but not by sap or by three species of aphids tested. The virus vector relationship was also studied and it was found that the virus was carried in the insect body in a persistent manner (Keshavamurthy, 1970). Further, it was shown that the virus was not infecting the ten species of graminaceous hosts tested and suggested the possibility of association of mycoplasma with this disease (Govindu *et al.*, 1970 *c*). Yaraguntaiah and Govindu (1968) screened 26 varieties of ragi for their behaviour against sap transmissible ragi mosaic virus (Delhi isolate) and found all of them were highly susceptible to the virus. Preliminary insecticidal trials with Carbofuron in the control of the vector, *C. bipunctella* indicated a decrease

in the population of the vector with a considerable reduction in the percentage of virus infection also (Govindu *et al*, 1971 *b*). Since similar epiphytotic disease on ragi was reported in Mysore State during 1945–46 also, Govindu *et al* (*loc. cit*) studied the epidemiology of the virus disease of ragi that occurred in epiphytotic form in 1966–67 by comparing the meteorological data and stated that these meteorological data particularly rainfall, maximum-minimum temperatures and humidity of 1945–46 and 1965–66 were almost same and hence the conditions that prevailed during 1945–46 once again appeared after 20 years and caused the epiphytotic disease on ragi in 1965–66

Studies on bottle-gourd mosaic virus were carried out by Janardhan (1968). The virus was recovered from all parts of the infected bottle-gourd plants indicating its systemic nature The movement of the virus in the inoculated bottle-gourd plants was also studied. The studies also indicated that the virus was transmissible by mechanical sap inoculations but not through any of the five species of aphids tested. Further, the virus was found to be having restricted host range infecting only 5 plant species in Cucurbitaceae and only one species in Amarantaceae. The causal virus was identified to be different from all the viruses reported earlier on bottle-gourd on the basis of its host range and certain physical properties though it resembled *Cucumis* virus-2B in certain respects (Janardhan *et al*, 1969). Muniyappa (1970) investigated bean mosaic virus and showed that the virus was seed borne and was readily transmissible by sap inoculations and by the 5 species of aphids tested The incidence of the disease was reported to be varied from 2·3 to 13·2 per cent and the virus was recovered from all the parts of the infected plants. The host range, physical properties, movement of the virus in the inoculated bean plants and the inactivation of virus by treating with different leaf extracts and other chemicals were studied The virus was shown to be inactivated by treating with leaf extracts of *Datura metal* Linn , *D stramonium* Linn., *Capsicum annum* Linn., *Chenopodium amaranticolor* and also by alcohol, glycerine, one per cent mercuric chloride, milk and garlic extracts. *Aphis fabae* sub-sp. *solenella* and *Lipaphis erysimi* were reported to be the new vectors for the virus. The virus was identified as a new strain of the common bean mosaic virus.

One of the most thought-provoking contributions in the control of plant viruses was made by Thirumalachar *et al.* (1971) who for the first time reported chemotherapeutic control of tomato leaf curl virus by DPB, an antiviral substance, as foliar spray at different concentrations (75, 100, 150 and 200 ppm) with 3–4 applications against tomato leaf-curl virus disease. These studies indicated that DPB at 75 ppm was more effective in reducing the infection by 50 per cent and at the same time in increasing the yield by 50 per cent when compared to control.

Coleman in 1909, for the first time established the bacterial nature of Brown rot of potato occurring in India and later Narasimhan (1940) suggested certain precautions to be taken against this disease. Not much headway was made in later years in this branch of science except for a brief note by Venkatakrishnaiah in 1957 pertaining to control aspects of citrus canker caused by *Xanthomonas citri*

(Hasse) Dows. However, since 1965 some systematic beginning has been made, in the study of important bacterial plant pathogens. Studies on black rot of crucifers caused by *Xanthomonas campestris* (Pam.) Dow., indicated that isolates from cabbage, knolkhol and cauliflower varied in their virulence (Namasivayam *et al*, 1971). There was variation in varietal resistance, with regard to post-infection changes in the host It was found that there was variation in reducing and non-reducing sugars in resistant and susceptible varieties. Total phenols were found to be more in resistant varieties than in susceptible ones In *in vitro* studies, *X. campestris* appeared to be more sensitive to streptocycline than to streptomycin and agrimycin (Namasivayam and Hegde, 1971). A new bacterial disease on ragi caused by a species of *Pseudomonas* was reported from Mysore State (Billimoria and Hegde, 1971). They reported the symptomatology as also morphological and physiological aspects of the pathogen Pathogen has been found to be systemic and soil borne. The characters of the pathogen and symptomatology of the disease are different from hitherto recorded bacterial pathogen on ragi (Billimoria, 1971).

Apart from the stray report by Venkatarayan (1932) on *Tylenchus* species forming leaf galls on *Andropogon pertusus*, Willd., not much work was done on plant parasitic nematodes in Mysore State until 1966. Swamy and Govindu (1966) made a comprehensive study of plant parasitic nematodes in Mysore State. They reported 12 genera, 16 species and one variety of nematodes on 52 hosts. They found that the root-knot nematodes caused maximum damage to vegetables. Among the important genera reported were *Aphelenchiodes, Helicotylenchus, Hirschmanniella, Hoplolaimus, Meloidogyne, Nothanguina, Pratylenchus* and *Trichodorus*. Swamy and Govindu (1967) reported the successful culturing (aseptic) of *Aphelenchoides asterocaudatus* Das on fungal diet (*Aspergillus flavus* Link and *Trichoderma* sp). Parvatha Reddy and Setty (1968) reported six nematode species occurring in Mysore State on cotton. The three important species reported were *Helicotylenchus retussus* Siddiqi & Brown, *Hoplolaimus indicus* Sher., and *Pratylenchus pratensis* (de Man) Filipjiv. They concluded that the nematodes may not cause much damage to cotton as they were observed in such a low population. Swamy (1968) studied response of five tomato varieties to two species of *Meloidogyne*, viz., *M. incognita* Kofoid and White and *M. javanica* (Treub.) Chitwood. He found that the tomato variety 'Best of All' was least susceptible to both *Meloidogyne* species. Prasad (1969) studied the effect of 3 amino acids and 3 plant growth substances as antimetabolites on root-knot nematode (*M incognita*) of tomato. He found that DL-Serine as a soil drench. was more effective in reducing the development and reproduction of nematodes in both sterilized and unsterilized soil, when given 4 days after nematode inoculation. Among the four soil fumigants and an oil-cake tested, E.D B. and Nemagoan were effective in reducing the nematode population in cotton (Parvat a Reddy and Setty, 1969). Swamy and Parvatha Reddy (1969) reported 10 nematode species in Areca rhizosphere of which 8 species are new records in India. Among the important species were *Helicotylenchus erythrinae*

Golden and *Pratylenchus brachyurus* Goodey. Setty and Parvatha Reddy (1969 *a*) reported that Thimet at 8 lb/acre reduced the rice root nematode, *Hirschmanniella oryzae* (V. Breda de Haan) Luc & Goodey, in both soil and roots of rice plants. Setty and Parvatha Reddy (1969 *b*) tested four varieties of brinjal for their resistance to root-knot nematodes Variety Long Purple Cluster was found less susceptible compared to other varieties. Nanje Gowda (1970) tested the efficacy of six oilcakes and found that the neem cake was more effective in controlling root-knot nematode, *Meloidogyne incognita*, on tomato Neem cake was more effective when it was given a week before inoculation of the root-knot nematode.

Extension Activities

Earlier to the establishment of University of Agricultural Sciences in 1965, extension work in the field of Plant Pathology was part and parcel of the several activities of the Department. During this period the Department participated in such activities as field visits, identification of problems and advocating suitable control measures and also educating the farming community by way of participating in field days, farmers forums, agricultural exhibitions and publishing relevant literature on Plant Disease Control in the form of popular articles and circulars both in Kannada and English. Since 1965 this Department has been assisting the Extension Wing of the University in spot inspections and advisory work whenever it is called upon to do so. Important results of research conducted in the Department are also released to the press now and then for the benefit of the farmers. Staff of the Department also actively participate in the Annual Meet of the Officers of the University and that of the State Department of Agriculture in formulating the package of practices. In recent years several publications in field of plant protection have also been published periodically from the Directorate of Extension, University of Agricultural Sciences. Amongst them, may be mentioned a brochure entitled *Plant Protection Pays*, a guide to protect high yielding crops. This publication provides useful information on the nature of pesticides and their compatibility, Plant Protection appliances as well as their maintenance. The brochure also includes information on major pests and diseases of high yielding varieties, *viz*, paddy, ragi, jowar, maize, wheat and bajra. Brief descriptions of symptoms supplemented with figures of most of pests and diseases of the six crops are given. In addition, combined schedules including information such as when to apply (stage of crop), what to apply with dosage of chemicals per acre and method of application is furnished. A unique feature of this publication is that for the first time, integrated control measures are included in the control of pests and diseases of each of the six crops. The entire publication is written in a non-technical language, so that the farmer will be able to understand and follow the control measures. A Kannada version of this has also been published.

SUMMARY

It is seen from the foregoing account that the Department started by Dr. L. C. Coleman at the dawn of the present century has made highly significant contribution in different fields of Plant Pathology especially during the last 25 years.

In Mycology. apart from strengthening the mycological herbarium and recording several new fungi along with their descriptions, monographic work on the genera *Cercospora*, *Ephelis* and *Balansia* have been published.

In the field of Plant Disease Control, extensive germplasm of ragi, paddy and maize has been screened against major diseases and promising material for hybridization has been identified. Some very effective fungicidal treatments have been developed for major plant diseases, notable amongst them being onion smut. *In vitro* studies with latest fungicides including systemics have yielded very useful indications as to their potentiality against soil-borne pathogens of major crops.

In Plant Virology, virus nature of ragi mosaic has been established, vectors determined and possible use of carbofuron to reduce vector population has been suggested. A very promising start in chemotherapeutic control of plant viruses has been made with antiviral substances such as D.P.B.

With regard to Plant Bacteriology, a beginning has been made with studies on post-infection changes in host plants.

In Plant Nematology comprehensive study of Plant Parasitic nematodes in Mysore has been made. Nematodes associated with vegetable crops and cotton have been identified. In the control of nematodes Thimet and neem cake have shown great promise in rice and tomato crops respectively.

As part of Extension Programme, popular articles and brochures have been published from time to time based on research results for the benefit of extension staff and farming community. Participation of the staff in farmers' Meet and Field Days have considerably helped in assessing the problems of the farmers and to reorient the research programme in Plant Pathology.

The Department of Plant Pathology is singularly fortunate to have received munificent grants from the agencies such as Ford Foundation, Rockefeller Foundation and United Nations Development Programme from time to time. This has enabled the Department to attain a high level of accomplishment both as a standard teaching and research institution in the country. It is now well set for the active participation in developing a centre of excellence in Plant Protection at post-doctoral level under the aegis of U.N.D.P., at University of Agricultural Sciences, Bangalore.

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Agricultural Entomology in Mysore : 1946–71

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THOUGH evidence of recognition of ravages of some of the crop pests and the need to control them could be seen in Mysore at the beginning of the present century, specific investigations on insect pest problems, however, were started some time in 1908 when a definite Entomology Division was organised by late Dr. Leslie C. Coleman as a part of the State Department of Agriculture. In fact, Mysore was one of the earliest among the Indian Provinces and States to organise Entomology Division for tackling pest problems of agriculture Dr. Coleman was ably supported in the very beginning by Dr. K. Kunhi Kannan who later took over the leadership. Even at that time, teaching research, and extension were perfectly integrated at the departmental level, which is, as is well known, the basic philosophy of the Land Grant Institutions of the U.S.A. and of our own University of Agricultural Sciences.

Dr. Kunhi Kannan was succeeded in turn by Mr. T. V. Subramaniam, Mr. B. Krishnamurti, Dr. M Puttarudriah, Mr. Seshagiri Rao, Mr. M. Appanna, and Dr. S. Usman. It was during Mr. Krishnamurti's term that the Agricultural College at Hebbal, was started Throughout this period, teaching, research and extension in Entomology was the responsibility of the Division of Entomology under the leadership of the Head of the Division.

With the inception of the University, there was a drastic change in the staffing pattern as well as their location. A separate group of staff with research as their main responsibility was set up and the personnel distributed over five Regional Research Stations. The teaching staff consisting at present of one Professor, one Associate Professor, five Assistant Professors and four Instructors are in position in the College. With the starting of the University the instructional system was also changed over in 1966 to a Trimester System with an entirely internal evaluation of student performance and such other innovative introductions. The Post-graduate programme leading to M.Sc. and later Ph D. degrees was also introduced. The teaching functions of the Department increased enormously. There are at present nine students working for M.Sc. degree and five for Ph.D. So far, 11 students have completed their M.Sc. programme and have taken the degree.

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Research

The research activities of the Entomology Division were mostly problem-oriented, though research of basic and fundamental nature were not altogether neglected. These are proposed to be reviewed briefly under different areas.

Crop Pests and Their Control

The starting of the Agricultural College was just after the close of the Second World War and this marked the beginning of the appearance in the market of the synthetic organic insecticides. The Division of Entomology did not lag behind and continued to screen several insecticides as they became available for their efficacy in the control of various insect pests. An effective control of the rice stem borer by the use of parathion was worked out based on field tests of different insecticides (Puttarudriah and Appanna, 1955 *a* 1956). Besides chemical control measures, the possibility of use of a trap crop established just before the main rice crop is planted in the control of the stem borer was also demonstrated (Puttarudriah and Appanna, 1957). Usman and Lakkundi (1968) screened several insecticides for the control of the sorghum stem borer and the delphacid bug. ChannaBasavanna *et al.* (1970) in a preliminary experiment found that there was less incidence of the sorghum shootfly in plots receiving higher levels of phosphorus. Usman *et al.* (1968) screened a large collection of ragi varieties for the incidence of the stem borer.

It was not mere testing of chemicals to find out the best insecticides in the control of insect pests, but the study of biology which included acquisition of knowledge on the detailed life-history, behaviour, other hosts, etc., of a number of pests was attempted. This information is necessary to devise effective ways of combating pests.

Puttarudriah and Maheswaraiah (1956 *a*) made an extensive review of insect pests of cotton with special reference to those occurring in Mysore. The same workers (1954, 1958 *a*, 1958 *b*) also made a study of the biology of the cotton looper (*Anomis flava* Fabr.) and of *Ricania fenestrata* and demonstrated that the latter, while being found principally on jasmine, could be considered as a potential pest of cotton. The cosmopolitan giant coreid bug, *Anoplocnemis phasiana* Fabr., was studied for its biology and external structure (Puttarudriah and Maheswaraiah, 1956 *a*). Puttarudriah and ChannaBasavanna (1953 *d*, 1956 *d*, 1957 *b*) made an extensive survey of the insects and mites occurring on areca palm in Mysore and their findings brought to light some new insects which were not known to exist earlier on this palm. Several chemicals were also tested for their efficacy in the control of the areca pink mite, which often becomes serious (ChannaBasavanna and Puttarudriah, 1958 *a*). A comprehensive review of insect pests of coconut palm was also provided (Puttarudriah and ChannaBasavanna, 1956 *b*).

The coconut caterpillar, *Nephantis serinopa* Meyr., which was known to be confined to the coastal areas in South India was for the first time noted in the interior of Mysore near Bangalore (Puttarudriah and Sastry, 1964) and is now being seen commonly around Bangalore.

Cardamom hairy caterpillar, *Eupterote* sp , which is known to occur in an epidemic form periodically was studied for its behaviour, general life-cycle and hosts and effective control measures were suggested (Puttarudriah, 1956 *c*). The incidence of two new looper caterpillars on the leaves of coffee was noted in Mysore (Puttarudriah and Usman, 1954 *b*). A pentatomid bug, *Udonga montana* Dist., is known of appear in millions periodically and this usually synchronises with the flowering of bamboo in the Malnad parts of the State. In 1954, another outbreak of this bug was noticed in Chickmagalur and Hassan Districts and detailed studies on the behaviour of the bugs during the outbreak period were made (Puttarudriah and ChannaBasavanna, 1954 *a*). It was found that though they congregated in large clusters on various crops thus scaring farmers, no damage was caused by them.

The guava scab gub, *Helopeltis antonii* Sign., is well known as a serious pest of guava in which infested fruits show scabs. It is also a serious pest of cashew inducing scorching of shoots and inflorescence. A detailed study of its biology, host-range and control has been made over years (Puttarudriah, 1952, 1958 *c*); Puttarudriah and Appanna, 1955 *b*). The yellow banded wasp., *Vespa cincta* Fabr., was noted to feed on and thus damage some fruits, like sapota and grapes (Thontadarya, 1968; Viswanath *et al.*, 1970).

Leaf curl in chilli is a serious malady responsible for heavy loss in yields. The organisms responsible for this complex have been studied. A very effective chemical control measure is now available for the control of this serious malady of chilli (Puttarudriah, 1959) Krishnamurti and Appanna (1948) studied the biology of the *lab-lab* pod borer. Usman and Krishnamurti (1952) made detailed investigation into the biology and control of the ragi stem borer, *Sesamia inferens* Walker. An integrated approach in the control of the potato Epilachna was suggested in which insecticidal application with stomach poisons rather than contact poisons was advised to be applied when parasite incidence was low (Puttarudriah, 1954 *b*).

An intensive screening programme with the extracts of different parts of various species of plants, which are known to be fish poisons, was undertaken to determine their toxic effect on various insects (Puttarudriah and Bhatta, 1955). Seshagiri Rao (1955) tested the corolla of flowers of different species of plants and pointed out their insecticidal potential.

In order to understand the potentialities of some of the minor pests of crops, studies on their host range and feeding habits were made. These studies included *Heliothis armigera* Habner (Puttarudriah, 1956 *b*), *Dichocrocis punctiferalis* Guenee

(Puttarudriah and ChannaBasavanna, 1951; Puttarudriah and Thontadarya, 1962), *Cacoccia epicyrta* Meyrick (Puttarudriah and ChannaBasavanna, 1950), *Azazia rubricans* and *Euproctis scintillans* Walker (Puttarudriah, 1947 *b*; Puttarudriah and Raju, 1952). *Loxostege messalis* Walker (Puttarudriah and Usman, 1954) and *Lymantria ampla* Walker (Veeresh and Puttarudriah, 1968).

Krishnamurti and Seshagiri Rao (1959) made extensive studies on the insects which infest stored grains and Puttarudriah (1953) has recorded one of the store pests, *Sitotroga cerealella* Oliver, as infesting sorghum grains on the standing crop and is thus carried to store from the field Thontadarya and Rajagopal (1969) found Dri-die as a protectant against pulse beetle

Puttarudriah (1955, 1956 *d*, 1956 *c*, 1961 *b*) compiled available information and put out bulletins in Kannada on the pests of rice, sorghum, ragi and pulses.

In the Division, efforts were also made to study certain non-insect pests of crops, apart from mites. Certain species of earthworms could spoil the texture of the soil and thereby make the soil unfit for cultivation was demonstrated and control measures were also evolved for the same (Puttarudriah and Sastry, 1961). Some work on the millipedes damaging crops was also initiated (Puttarudriah, 1959; Rangaswamy and ChannaBasavanna, 1969).

Biological Control

Mysore has been pioneering in respect of biological control of insect pests of crops. The laboratory for purpose of mass-rearing Trichogramma parasite and release in sugarcane fields for the control of the seedling borer was started in 1935 and is still continuing. Attempts were also made to release the parasite in the sorghum fields in Bellary to control the stem borer (Puttarudriah and Usman, 1957), and also to introduce and establish *Melcha ornatipennis* Cameron for the control of the sugarcane top borer in Mandya area. Observations made later revealed recovery of the parasite (Puttarudriah, 1960, 1961 *a*). A detailed study of the biology of the pupal parasites, *Tetrastichus ayyari* Rowher led to an attempt to utilise this parasite in the control of the sugarcane borers (Puttarudriah and Sastry, 1958). Two special projects were operating in the Division for several years, one for the investigations on the different parasites of the sugarcane borers (Usman *et al.*, 1957) and another on the several other crop pests (Usman *et al.*, 1964). These two projects brought to light several parasites of different pests and their role was established.

The rice grasshopper, *Hicroglyphus banian* Fabr , was discovered to be attacked by an egg parasite, *Scelio hieroglyphi* Timberlake, biology and mode of parasitization of which was studied (ChannaBasavanna, 1953). An interesting phenomenon of phoresy in an allied species was also studied (ChannaBasavanna, 1953 *a*, 1953 *b*,

1953 *c*). The same author (1957) and Puttarudriah and ChannaBasavanna (1953 *b*) made an extensive study of the predators of mites. With a view to investigating the possibility of developing an integrated control of two of the major groups of crop pests, namely, the aphids and the mealy bugs, an extensive survey and study of the predators of these groups was undertaken (Puttarudriah and ChannaBasavanna, 1957 *a*, 1957 *d*). Similarly, the same authors (1956 *c*) studied the predators of the coffee green bug The *lab-lab* pod borer is a serious pest of the field bean in Mysore and is difficult to control. A survey for the parasites of this pod borer revealed a few larval parasites, of which *Bracon lefroyi* was an important one (Puttarudriah and ChannaBasavanna, 1956 *a*, 1957 *c*) and attempts to mass-rear this parasite under laboratory conditions failed.

All the available information on the recorded parasites of the fruit flies occurring in Mysore was compiled (Puttarudriah and Usman, 1954 *a*). Recently, ChannaBasavanna and Prasad (1961) recorded *Trichogrammatoidea* sp. nr. *nana* on the eggs of the sciomyzid fly, *Sepidon sauteri* Hendel, which is a new record on a Diptera.

Detailed studies on the biology of some predators were also made in order to explore the possibility of utilising them in the biological control of concerned pests. Puttaswamy and ChannaBasavanna (1971) gave an account the biology of the common coccinellid predator, *Stethorus pauperculus* Wse , and similarly, the biology of the giant coccinellid, *Synonycha grandis* Thun., was also studied (Puttarudriah and Maheswaraiah, 1966). Veeresh (1971) studied the biology of another coccinellid, *Axinoseymnus puttarudriahi*, a predator of white flies. The assasin bug, *Isyndus heros* Fabr., was studied for its biology (Veeresh and Puttarudriah, 1970) with a view to utilise this general predator in the control of pests occurring in a tree habitat.

Taxonomy and Faunistic Studies

The Division developed taxonomic and faunistic studies particularly in two major groups, namely plant feeding mites and the Coccinellidae in addition to contributions in respect of other species.

ChannaBasavanna (1966, 1967) has been making extensive contributions on the taxonomy of the eriophyid mites of India. Out of 70 species of this group known from India, 61 were recorded as newly occurring in India during these investigations Of these 44 species were new to science. Other plant feeding groups of mites are also being studied for their taxonomy and biology. Though reddening of leaves of sorghum due to a spider mite was known earlier the first definite record of the sorghum spider mite and its coccinellid predator was made in 1947 (Puttarudriah, 1947 *a*). A preliminary account of the phytophagous mites occurring in Mysore was presented at the First All-India Congress of Zoology (Puttarudriah and ChannaBasavanna, 1959 *c*).

The causes of mango malformation, which have been and are the subject of controversy, were sought to be discovered, and in an experiment which involved inoculation of the eriophid mite on to a healthy seedling, it was proved that mite was concerned in the vegetative malformation (Puttarudriah and ChannaBasavanna, 1961 *a*). The discovery in India of the eriophyid mite vector of the wheat streak and wheat spot mosaics in the U S A. and Canada is a significant contribution (Puttarudriah and ChannaBasavanna, 1958) indicating the possibility of the spread of these diseases in the country, if inoculum is available The development of a brownish corky tissue on the surface of guava fruits was demonstrated to be due to a false spider mite (Puttarudriah and ChannaBasavanna, 1959 *b*), ChannaBasavanna and Puttarudriah (1959) indicated that the polyphagous tarsonemid mite, *Polyphagotarsonemus latus* (Banks), could become a serious pest of cotton.

Recently, systematic studies on the spider mite family Tetranychidae were undertaken and species coming under different genera of Tetranychidae have been studied. Diagnostic characters keys and hosts have been provided (ChannaBasavanna and Kubra Banu, 1971 *a*, 1971 *b*). The biology of the common polyphagous spider mite, *Eutetranychus orientalis* (Klien), has been studied recently (Kubra Banu and ChannaBasavanna, 1971). The literature on plant feeding mites in India is scattered and thus not easily accessible to those who wish to start work on these mites. In order to meet this requirement a bibliography of plant feeding mites was compiled (ChannaBasavanna and Nageshchandra, 1971). ChannaBasavanna (1971) presented a paper on the current status of our knowledge of the Indian plant feeding mites before the Third International Congress of Acarology at Prague, in which he reported that 111 species of mites are known to occur in India and that our knowledge on them has increased rapidly during the last 6–7 years rather than the previous 6–7 decades.

For a long time Epilachna beetles on solanaceous crops, like potato and brinjal and on cucurbitaceous plants were considered to be the same species. Biosystematic studies and examination of the genetalia proved that the species on solaneceous crops is different from the one occurring on cucurbitaceous crops (ChannaBasavanna, 1954). Similarly, an intensive study of the bean aphid, *Trifidaphis gossypii* Pass., indicated that a species described as new from the roots of cotton from Mysore may be same as *T. gossypii* with variations (ChannaBasavanna, 1958 *b*, 1962). Extensive studies on the identity of two common species of braconid parasites, namely, *Bracon hebetor* Say and *B. brevicornis* Wesm., were also made (Puttarudriah and ChannaBasavanna, 1954 *b*; 1956 *b*). The green bug (*Coccus viridis* Green) occurring on citrus and sapota were found to be consistently differing slightly from that found on coffee though they apparently look alike (Puttarudriah and ChannaBasavanna, 1953 *e*).

A faunistic study of beneficial coccinellids was pursued in the Division for several years and as a result of this study over 60 species of predatory coccinellids

were brought to light (Puttarudriah and ChannaBasavanna, 1952 *b*, 1952 *c*, 1953 *a*, 1955, 1956 *c*, 1959 *a*). Biology of the giant coccinellid, *Synonycha grandis* Thun., a predator usually associated with the bamboo shoot aphid, was studied in detail (Puttarudriah and Maheswaraiah, 1966). A special project on the predatory coccinellids sponsored by the Indian Council of Agricultural Research was in operation for a couple of years.

Usman and Puttarudriah (1955) compiled a list of insects and mites known to be occurring in Mysore.

An interesting observation that some of the bugs that lay eggs inside plant tissue have the habit of first probing with the mouthparts before inserting the ovipositor for laying eggs was made in respect of certain tingids, *Helopeltis antonii* Sign., and *Perigrinus maidis* (Ashmead) (Thontadarya and ChannaBasavanna, 1959, 1962, 1968). During his brief stay in Japan, ChannaBasavanna and Yano (1969) studied the factors responsible for diapause during winter months in the sciomyzid fly (*Sepedon sauteri* Hendel) in the southern region of Japan

Extension activities were an integral part of the Division of Entomology. In the past, before the University came into being there were no exclusive extension entomologists as there are now. Still, by and large every staff member in the Division had integrated in him all the three functions, teaching, research and extension to varying degree. Before a separate Plant Protection Organisation was established on a small-scale in 1948, it was not only extension education but also actual control operations were at times undertaken with the co-operation of local agencies, such as Village Panchayats. Several control campaigns were organised that way whenever there was a widespread outbreak of a pest, as for example, in the case of outbreak of redheaded caterpillar, Deccan wingless grasshopper and of the rice Leptispa. These campaigns worked successfully and were fine examples of a co-operative effort of the Division, Extension Officers of the Department of Agriculture, Village Panchayats and individual farmers, and on some occasions co-operation of local schools was also sought, which was forthcoming most voluntarily.

A separate Plant Protection Unit on a small-scale was organised for the first time in the State in 1948. The Head of the Division of Entomology continued to be the Head of this organisation till about the early 1960s when a separate Plant Protection Officer was appointed. The close knit integration of the three facets of activities of the Division was furthered by this set up where the Government Entomologist was the head of the State Plant Protection Organisation. This set up greatly enhanced the teaching, training and research activities of the Division, since every staff member, though his designation was Entomologist, or Assistant Professor or Research Assistant was intimately involved in the entire programme and thus knew what was going on in the field.

In conclusion it may be stated that the Division of Entomology not only kept up the tradition of good work started by the late Dr. Leslie C. Coleman and its service to the people and development of agricultural entomology but also expanded and contributed quite considerably to the science in the country during the past quarter of a century Its pioneering contributions in the field of biological control and in the plant feeding groups of mites, the achievements in the extension of research and service to farmers and the research contributions leading to the solution of major pest problems are outstanding ones of which the Division of Entomology can justifiably feel proud.

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Agronomic Investigations in Mysore : 1946–71

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THE beginning of agricultural research in Mysore State can be traced back to 1886, when for the express purpose of promoting experiments in agriculture, an officer at the State level was appointed. Besides promoting the cause of agriculture and collecting statistics, he was holding the Office of the Inspector-General of Police and Forests and Plantations. This Office was abolished in 1892 and the work of experimental cultivation, cattle and pony breeding operations remained under the Inspector-General of Forests. A real break through was made in the history of agricultural development in the State when an experimental farm consisting of about 30 acres near the Hebbal Village, in the Bangalore Taluk (now the Main Research Station, Hebbal) was established in 1904–05 to furnish results of practical value to the agriculturists. Interested farmers were trained in farm practices such as the use of improved implements, improved methods of seed production, use of chemical fertilizers, preparation of jaggery, etc., Dr. Lehmann, the then first Agricultural Chemist made experiments in sugar making and claimed to have demonstrated the practicability of greatly improving the quality and quantity of the yield.

The earliest notable and valuable work in Agronomy dating back to the establishment of the Hebbal Farm was that of testing on a field scale the ragi varieties produced by the Botanical section. The local *Hullubele* was replaced by improved varieties of ragi. H_{22}, L.S. 11 and R.O. 806 were the improved varieties recommended for cultivation under dry land conditions with potential to withstand drought. Other notable varieties were K-1 in Kar ragi, selections from GEB_{24}, and SR. 26B in paddy, HG_1, HG_2 in groundnut and HM320 in sugarcane.. Two varieties of soybean, White Mammoth and K-16 were also recommended around 1952. Another interesting result was that obtianed with the use of ammonium sulphate as a manure to ragi which lead to increased yields. The experiments on paddy manuring also showed that a combination of oilcake and superphosphate were decidedly profitable, while superphosphate alone was not.

The Department of Agriculture initiated Annual Agricultural Conferences in 1959. In the first conference, Prof. K. A. Jalihal reviewed the highlights of results obtained from Agronomic research conducted by the Agronomy Department in the previous years. Ploughing with improved iron plough was found to be better. In the rotational trial, it was found that ragi after groundnut gave 50 per cent more

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grain yield over the treatment with ragi after ragi. Green manuring with sunhemp was found to increase the yield of ragi by 30 per cent. In the manurial trials, it was found that 20 lb nitrogen, 30 lb phosphoric acid and 20 lb potash gave 22 per cent increased yield over no fertilizer when chillean nitrate was used and 17 per cent increased yield over no fertilizer when ammonium sulphate was used. Mere application of phosphates and potash in the absence of nitrogen did not increase the yield. In the placement trials, 56 lb phosphoric acid placed 4 inch deep increased the yield over broadcast method. Seed treatment with $ZnSO_4$ at 0·5 per cent solution increased the yield of ragi by 7 per cent.

From the experiments on paddy, it was found that irrigation once in 3-5 days was not better than local practice of flooding The results on spacing trials on paddy were inconclusive. However, it was observed that closer spacings of 3 inch within rows gave better results than spacings of 6, 9 or 12 inches From the fertilizer trials on paddy, it was found that 30 lb nitrogen and 40 lb phosphoric acid with 2,400 lb farm-yard manure and 3,000 lb Honge leaves was optimum.

From the manurial experiments on groundnut, it was observed that 35 lb phosphoric acid and 35 lb potash was found to be better than check on the limed series plots and that addition of 10 lb nitrogen did not increase the yield any further. In the unlimed series, 35 lb phosphoric acid alone gave better results than in combination with potash or nitrogen.

The Agronomy Department acquired due importance with the starting of the University. Besides involving itself in a big way in instruction at the undergraduate level, it is operating a PL-480 research project entitled "Investigations on the structure and yield in cereals, Maize and Sorghum". The department has two more research projects operated at the Agronomy Field Unit, one on Pulses and the other on Barley, as the USAID rupee support projects. They are: (i) Improvement of Pulse Crops in Mysore; (ii) Feasibility studies on the growing of malting barley in Mysore State. In this article an effort has been made to review the research activities carried out in the last 25 years from 1946, in the Department of Agronomy.

Crop Introduction and Production Practices

The Department of Agronomy has been the foremost in the crop introduction programme with Paddy, Hybrid Maize, Mexican Wheat, Barley, Oats, Soybeans and Sunflower. *Taichung*-65 variety of paddy was introduced from Taiwan for the first time in the State by the Department. Improved high yielding varieties of paddy from Australia, YLR_1 and YLR_2, were compared with IR-8 and tested for adaptability under Hebbal and other conditions. Both these varieties fared better (over 3,000 kg/ac) as compared to IR-8 (2,204 kg/ac) during summer 1968. Further studies, on these are in progress, (Krishnamurthy and Ashok Kumar, 1969). Two sunflower varieties, *viz.*, *Aramariskij* from USSR and *Sunrise* from

USA were introduced and studied for adaptability. Sunrise was found to yield better with 850 kg per acre compared to other variety with 370 kg per acre (Krishnamurthy, 1969). Further studies are in progress on the agronomic aspects of Sunrise variety.

Considerable efforts have been put into introduce Soybean varieties in the State (Krishnamurthy, 1969). Over 100 varieties were tested for adaptability and yield and it was observed that among short duration varieties of 90–105 days, *Davis*, *Hill* and *Hood* could be recommended for general cultivation while among medium duration varieties *Hardee*, *Bragg* and Improved *Pelican* have been found to perform well (Shivashankar *et al*, 1972).

24 groundnut varieties from America and Africa have been under observations and a few promising ones would be introduced for general cultivation shortly (Krishnamurthy *et al.*, 1970). 38 Barley varieties from America and Africa, and 31 wheat varieties have been under row trials for adaptability (Krishnamurthy *et al.*, 1970). Krishnamurthy (1967) explored the possibilities of growing hybrid maize *Ranjit* as rainfed crop at Hebbal by planting it in the second week of July. It gave an yield of 29 quintals per acre.

Krishnamurthy (1969) studied the transplantability of CSH-1 hybrid sorghum to avoid shootfly damage It was found that the transplanted crop suffered less from shootfly damage and yielded better than direct seeded crop.

Krishnamurthy (1968) studied the tillering pattern in dry land H_{22} variety ragi and found that the grain yield per plant and the number of shoots produced within five weeks of transplanting were related. The main axis contributed 24 per cent while early, intermediate, late and secondary tiller groups contributed 47, 16, 8 and 5 per cent respectively to the total grain yield. Krishnamurthy *et al.* (1969) tried the mixed cropping of ragi with sugarcane and found that Purna ragi gave 544 kg grain in 55 days after transplanting. In such a case, it was found essential to provide extra nitrogen to sugarcane.

The possibility of ratooning of *Taichung*-65 was explored. It was found to be not profitable to do so far this crop in summer (Krishnamurthy, 1968).

Krishnamurthy (1968) made an attempt at a successful growing of sunhemp green manure crop under rainfed conditions by drill sowing in May rains and turning in by mid-July. The 50-day old crop was found to give 4,897 kg of green matter per acre.

Chandrasekharaiah and Krishnamurthy (1968) studied the growth analysis of four wheat varieties *Sonara*-64, *Sona*-227, *Lerma Rojo* and *Bijaga* Yellow under various fertility levels and irrigation, to explore the possibilities of aclamatization of wheat in Bangalore region. Further studies with Australian wheat, indicated that variety *Gamut* out yields Mexican wheats, besides being resistant to stem rust,

In the studies covering introduction of Oats to Mysore, NP 101 has shown promise. In barley, several grain and malting types have shown promise.

Investigations on Water Regimes and Salt Concentrations on Field Crops

Achar and Ananthanarayana (1969) analysed samples of water in Hebbal and found that well waters could be safely used while tank water could be used only under proper drainage conditions so that salinity hazards could be avoided.

Hegde (1969) in his studies on the moisture stress on 6 crops, *viz.*, Sorghum, Ragi, Maize, Bajra, Castor and Sunflower at different growth stages, established that preflowering stage was the most critical period in all these crops. In another study, on the critical stages in soybean plant with respect to moisture stress, (Hegde and Ashok Kumar, 1970) in lysimeters, used variety Hill as a test plant. The plants in one of the lysimeters was subjected to drought (indicated by the resistance in Gypsum blocks) at a particular stage of growth and during remaining period it was watered normally at 0·5 atm. tension indicated by tensiometer. By subjecting the plants to drought stress at germination and early seedling growth, the plant height was reduced considerably (54·9 cm as against 71·2 cm in control, the one that received irrigations at 0·5 atm. tension). It was also found that the highest grain yield was recorded with irrigations at 0·5 atm. tension (1·55 kg/25 sq ft) and the lowest by subjecting the plants to drought stress at the late flowering and fruiting stages (1·1 kg/25 sq ft).

In another experiment, on optimum water regime for paddy, Hegde and Ashok Kumar (1970) worked on *Taichung*-65 with four levels of water, *viz.*, standing water of 5 cm, standing water of 2·5 cm, irrigation at 0·1 atm. tension and irrigation at 0·3 atm. tension were the four treatments, tried in cement cisterns. It was observed that a depth of 2·5 or 5 cm water standing gave significantly higher yield in comparison with other treatments. These treatments were also found to produce higher number of tillers per plants. Hegde and Ashok Kumar (1971) conducted an experiment to find out the salt tolerance in 7 paddy varieties, *viz.*, IR–8, T–65, YLR–1, YLR–2, Jaya, Padma, Hamsa and SR–26 B with four salt levels (made up by equal proportion of $CaCl_2$ and NaCl) created in pots, *viz.*, 0, 0 125, 0·25 and 0·50 per cent respectively. The growth of plants was reduced with salt levels above 0·25 per cent. It was also observed that the period of maturity was prolonged with increasing levels of salts The earhead emergence was delayed by 8–12 days in pots receiving highest level of salts. Of the varieties tried, IR–8, SR–26 B and Padma were found to be more salt resistant than the rest of the varieties. In these varieties the tiller number per plant did not come down but the number of effective tillers was reduced by the increasing salt levels in soil. In the salt tolerance studies conducted by Achar (1968) germination of paddy, ragi, and wheat varieties was tested with different solution of salts prepared to give osmotic concentrations from 1–8 atmospheres. The results indicated that there was a general trend of

decrease in germination with the increase in osmotic concentrations and that IR–8 and *Taichung*–65 could tolerate in terms of sodium chloride salt more than SR 26–B at germination while Mexican wheat varieties were less salt tolerant than *Bijaga* yellow.

Investigations on the Soil Fertility Management

In a fertilizer trial on paddy, Taichung–65 responded upto 90 lb nitrogen per acre, compared to no response beyond 60 lb N per acre in the case of Ch 10 (Rajashekara, 1966). In another trial with 4 levels of manuring, *viz.*, (1) 0 : 0 : 0, (2) 60 : 30 : 30, (3) 120 : 60 : 60 and (4) 180 : 90 : 90 lb per acre respectively of nitrogen, phosphoric acid and potash, and with four different spacings, *viz.*, (1) 6″ × 4″, (2) 6″ × 6″, (3) 9″ × 6″ and (4) 9″ × 9″, highest yield of 7,000 lb per acre was obtained with 120 : 60 : 60 lb nitrogen, phosphoric acid and potash per acre with the lowest spacing of 6″ × 4″ (Rajashekara, 1966). In another trial, (Rajashekara, 1966), with three varieties, *viz.*, Ch. 10, Taichung–65 and H. 1043, five levels of nitrogen *viz.*, 0, 30, 60, 90 and 120 lb per acre with 4 different split applications, *viz.*, (*a*) all at planting, (*b*) 70 per cent at planting *plus* 20 per cent at one month after planting *plus* 10 per cent at flowering, (*c*) 50 per cent at planting *plus* 50 per cent at flowering and (*d*) 50 per cent at planting *plus* 25 per cent at one month after planting *plus* 25 per cent at flowering, the results indicated that *Taichung*–65 responded upto 120 lb nitrogen per acre Ch-10 upto 90 lb nitrogen per acre and H. 1043 upto only 60 lb nitrogen per acre. The differences between split applications were not marked. In an experiment on split application of potash on Taichung–65, (Prabhakar *et al.*, 1970), it was found that there were no significant differences between single application and split application, although split application of potash gave a slightly higher yield.

Experiments conducted on the Hebbal farm indicated that the yield of dry land ragi increased with the increase in nitrogen and phosphorus from 0–80 lb in case of nitrogen and from 0–30 lb in case of phosphoric acid. There was no response to potassic fertilizers (Dixit, 1966).

With H_{22} ragi, it was observed that with the addition of nitrogen from 0–80 lb per acre in increasing levels of 20 lb, the grain yield increased linearly, (Krishnamurthy, 1968) In another trial under irrigated conditions, it was found that varieties responded differently in grain yield with doses varying from 0–120 lb nitrogen per acre. This was related to tillering pattern. Yields depressed at 80 lb nitrogen with Annapurna, whereas in Purna, yields increased upto 120 lb nitrogen; IE 267 produced better yield, at 120 lb nitrogen while H_{22} gave higher yield at 40 lb nitrogen level.

Dixit (1967) and Ananthanarayan (1968) found that among different sources of nitrogen tried on dry land ragi, calcium-ammonium nitrate at 100 kg per hectare gave good grain and straw yields. This was followed by ammonium sul-

phate-nitrate, urea and ammonium sulphate but there were no differences between these. Manchegowda (1967) studied the placement of fertilizers for dry land ragi with a view to find out the relative effects of (i) broadcasting, (ii) placing along with the seed, (iii) placing 2" away and 2" below the seed and (iv) placing 2" below the seed, with two levels of fertilizers, *viz.*, 30 lb nitrogen and 30 lb phosphoric acid per acre and 60 lb nitrogen and 60 lb phosphoric acid per acre in single and split doses. It was observed that there were no significant differences in yields with different treatments.

In an experiment conducted for 6 years to find out the most profitable rotational crop to go with the most popular cereal crop of the region, Ragi (Shivashankar *et al.*, 1972) the following points have emerged:

(i) It was detrimental to the yield of crop to grow Ragi after Ragi year after year. The poor performance of the crop was improved and the low grain yields could be made good if the crop was fertilized at 75 and 50 kg of nitrogen and phosphoric acid per hectare respectively or alternatively if the land was left fallow uncultivated every alternate year; (ii) Among the combination of crops, the two most profitable rotations were (*a*) Ragi after groundnut, (*b*) Ragi after avare; (iii) Among the oilseeds, it was better to take up Ragi after groundnut, and Ragi after castor Niger were not efficient in enhancing the yields of Ragi, (iv) Among the pulses, Ragi after Avare was found to be better than Ragi after Horse gram; (v) Uncultivated fallow was better than clean fallow in enhancing the yields.

Studies on nutritive content of ragi varieties were made by Krishnamurthy (1968). It was observed that protein content was highest in Purna (5·6 per cent) and lowest in H_{22} (4·7 per cent) and the calcium content was highest in H_{22} (445 mg) and lowest in Purna (228 mg). The other two varieties tried, *viz.*, Cauveri and Annapurna were within these limits. It is interesting to note that protein content increased (5·2–7·0 per cent) and calcium content decreased (368 mg to 342 mg) with the increasing levels of nitrogen from 0–120 lb, while addition of phosphatic fertiliser enhanced the calcium content.

In a long range manurial trial on dry land ragi, Shivashankar *et al.* (1971) observed that a combination of 67·2 kg nitrogen, 44·4 kg each of phosphoric acid and potash per hectare gave the highest grain yield of 908 kg as against 353 kg in the control without fertilizer application.

Yandagoudar (1968) studied the performance of two wheat varieties *Sona* 227 and *Lerma Rojo* and found that there was gradual increase in yield in both the varieties when nitrogen level was increased from 0–150 lb per acre. *Lerma Rojo* was better than *Sona* 227 Chandrasekharaiah (1969) working with the same two varieties, with 6 levels of nitrogen remains from 0–60 kg per acre with increments of 12 kg, observed that both of them responded linearly. In another experiment, Chandrasekharaiah (1969) correlated the dry matter produced with that of grain

yield in four varieties of wheat, *viz.*, *Sonara*–63, *Sona*–227, *Lerma Rojo* and *Bijaga yellow*. In all the varieties yield increased with the increase in total dry matter. *Lerma Rojo* gave the highest total dry weight of 4·66 g per plant compared to other varieties. *Sona*-227 and *Sonara*-63 registered more grain weight per plant as compared to *Bijaga yellow* and *Lerma Rojo*.

From the studies, on the response of hybrid maize varieties *Deccan* and *Ranjit* to nitrogen, Krishnamurthy (1968) found that varieties responded differently. Nitrogen was given from 0–300 lb per acre, in increasing levels of 50 lb, with a common dose of 60 lb phosphoric acid and 30 lb potash. With *Deccan*, the yield increased upto 200 lb nitrogen per acre whereas *Ranjit* responded upto 150 lb nitrogen.

In a fertilizer trial on three varieties of maize, *viz.*, *Ranjit*, *Ganga safed* and *Histarch*, Katti (1967) found that there were no significant differences in yield due to the three fertilizer levels of nitrogen, *viz.*, 120, 160 and 200 lb tried. However, it was observed that *Ranjit* gave 26 per cent more grain yield than those of *Histarch* and *Ganga safed*. A dose of 120 lb nitrogen was thus found to be optimum for all these varieties.

From the mineral nutrition studies on Soybean, Shivashankar (1970) found that *Davis* variety of Soybean responded to foliar application of urea (2 per cent and 4 per cent), molybdenum and zinc (1 per cent each) and a combination of urea (2 per cent) molybdenum and zinc (1 per cent each) as in the case of the same through soil application. It was observed that the yields were better in summer compared to those obtained in *kharif*. Shivashankar (1968) in a pot culture study found that soybeans did not tolerate phosphatic sprays of more than 2 per cent concentration in the form of orthophosphoric acid. Shivashankar *et al.* (1972) found that higher yields were obtained in summer, compared to those obtained in *kharif* in a fertilizer trial conducted for two seasons. There was a trend of increase in yields with the increase in phosphate applications from 0–40 kg per hectare. Highest yields of 47 quintals per hectare were obtained in summer with the treatment of 20–40–40 kg of nitrogen, phosphoric acid and potash respectively.

In a fertilizer trial on sunflower variety *Sunrise*, Hegde and Ashok Kumar (1970) found that 40–40–20 kg of nitrogen, phosphoric acid and potash respectively per acre was optimum under irrigated conditions.

Control of Weeds in Field Crops

Lingegowda (1967) found that preemergence spray of 2, 4–D at 1½ lb per acre gave satisfactory control of weeds and increased grain yield by 190 per cent over control followed by Stam F. 34 which gave 120 per cent increase in yield over control. It was observed by Prabhakar *et al.* (1969) that Stam F-34 at 4 litres per acre checked weed growth in paddy and increased the grain yield by 10 per cent

compared to that of unweeded control. With *Taichung*–65, Shivaraj *et al.* (1971) found that 2, 4–D at 0·5 kg per acre with 3 per cent urea, gave a maximum yield of 3,213 kg per hectare followed by Stam F–34 at 4 litres per acre with an yield of 3,000 kg per hectare.

Rajashekhara (1967), testing several chemicals to control weeds in ragi, found that Stam F–34 at 4,000 cc. per acre as postemergence spray was effective in controlling weeds while maximum yields were obtained in hand weeded plots Simazine and Atrazine had harmful effects on the establishment of crop as post emergence sprays. Krishnamurthy (1967) found that Simazine at 1 kg per acre as preemergence sprays provided satisfactory control of weeds except nut grass in Maize. Paraquat as postemergence spray at 500 ml per acre indicated the possibilities of its careful use and gave satisfactory control of nutgrass.

Yandagoudar (1968) observed that none of the weedicides used as postemergence sprays had any adverse effect on the growth of Maize. Most of the weeds were killed by 2, 4–D at 1·5 lb per acre and paraquat at 0·5 litre per acre both as postemergence sprays. The fresh weight of the weeds was least in the Atrazine treated plots and maximum in the control plots. Atrazine at 1 kg per acre given as preemergence spray gave maximum grain yield of maize as that of postemergence sprays of 2, 4–D Hosamani (1968) found that maize varieties were having maximum tolerance to weedicides Atrazine and 2, 4–D followed by those of sorghum. Prabhakar and Ramadass (1969) studied the tolerance of maize, bajra and jowar varieties to herbicides at 0·5, 1·0, 1·5, 2·0, 2·5 and 3·0 kg per hectare of Atrazine and 1·0, 2·0 and 3·0 kg per hectare of 2, 4–D at emergence It was found that highest germination per cent of 90 was observed in maize followed by jowar (60 per cent) and Bajra (40 per cent). Hosamani (1968) studied the germinability of weeds and found that *Cyperus rotundus* had more capacity to withstand prolonged dry conditions.

Investigations on the Structure of Yield in Cereals (Maize and Sorghum)

Improvements in crop yield can be brought about largely by advances in two directions; crop management and plant breeding. In order to investigate these relationships, a physiological approach to the study of growth, using more fundamental measures of changes in dry weight, leaf area, shoot number, etc , would become more useful and effective By these means, it is hoped to identify the more economically valuable growth characters and thus define more precisely the problems of plant breeder. In fact, even in the recently developed high yielding varieties, the growth mechanism operating for such yield is not yet clearly understood. In addition, improvements in yield can be easily effected by a proper understanding of the growth reactions of the crop plant that determine yield, to the changes in the cultural procedures. In India, investigations on the problem of cereal yield is most urgent. It is hoped that the application of cereal yield analysis technique

to the problem of grain yield would help to increase the yield from an unit area of land. Further, the agronomist, the breeder and the physiologist can find in them the raw material for profitable future investigations.

Research in Maize.—In a varietal performance test with different maize germplasms (*Deccan Hybrid, Ganga Safed, Ganga–5, Mexican June, Amber* and *Arabhavi Local*) under normal field conditions on a red sandy loam soil of Bangalore, with protective irrigation, maximum grain yields were recorded by the *Deccan Hybrid* and *Mexican June* (43 q/ha). followed by *Ganga–5* (40 q/ha), *Ganga Safed* (29 q/ha), *Amber* (35 q/ha) and the lowest in the case of *Arabhavi Local* (13 5 q/ha). These differences in the grain yield among the varieties was mainly due to differences in the mean grain weight per cob. The mean grain weight per cob differed because of more differences in the test weight rather than the differences in the grain number per cob. The reasons for differences in the grain yield components may be attributed to differences in the growth components like Leaf Area Index, Leaf Area Duration and the rate of dry matter accumulation per plant and percentage distribution of dry matter to cob. Varieties which had more LAI and LAD produced more dry matter per plant with more distribution of dry matter to grain alone and as a consequence they expressed better growth components and in turn yield components leading to higher grain yield.

Dry matter accumulation was gradual and slow upto 45 days from sowing and only from 45th day onwards there was very rapid and linear dry matter accumulation in maize plants, upto harvesting. At the final harvest nearly 60 per cent of the dry matter produced accumulated in the cob alone and the rest accumulated in the non-cob portions of the plant. NAR did not vary among the varieties and between seasons and also it did not show any time trend.

In a study to find out the optimum date of sowing of maize in Bangalore, it was observed that summer months gave maximum yields (100 q/ha) followed by *kharif* months (87 q/ha) and the lowest in the *rabi* (80 q/ha). The differences in the grain yield in different seasons might be attributed to differences in the length of the cob. Maximum grain weight per cob was recorded in summer months since the cob length was highest because of no damage to the leaves by the diseases like *Helminthosporium* and as favourable temperatures for the expansion of leaves existed. Plantings made in September, October and November resulted in lowest yield because of the incidence of *Helminthosporium* disease leading to reduction in the LAI and LAD and as a consequence reduction in the length of the cob.

To find out the optimum level of nitrogen fertilization and plant population for maize, an experiment was conducted with four levels of nitrogen (60, 120, 180 and 240 kg/ha) and three levels of plant population (45,000, 60,000 and 75,000 plants per ha). It was found that maximum grain yields of 85 q/ha was obtained with 240 N, 80 P_2O_5, 40 K_2O, and 20 zinc sulphate (kg/ha) with 60,000 plants per ha because of more number of medium-sized cobs harvested per hectare.

In a moisture stress study at different critical stages of growth, it was observed that there was a reduction of yield by 42 and 21 per cent due to moisture stress at the time of flower and grain filling stages respectively for a period of 5–6 days, while the effect of moisture stress was not significant at seedling stage as well as at dough stage. The causes for yield reductions was mainly due to increase in the per cent barrenness and decrease in the 1,000 grain weight In a weed control experiment, with different levels of Atrazine and Banvel-D, it was observed that spraying of Atrazine at 2 kg/ha at preemergence has given better weed control and highest grain yields as compared to other low levels of Atrazine or Banvel-D in a light textured soil of red sandy loam.

In a defoliation study in maize, complete defoliation at the time of tasseling and late pollination stages resulted in 98 and 50 per cent reductions in grain yield respectively, owing to the reduction in the photosynthesizing surface, shock of defoliaiton and the consequent physiological imbalance in the growth phenomena. Among the different positions of leaves on the plant, the top and middle four leaves were found to be more important than the bottom four leaves in contributing for more grain yield.

Research in Sorghum.—In an experiment, four genotypes of sorghum, *viz.*, Hybrid CSH–1, CBE–X (MS 2219 × IS 3541), Swarna and Siruguppa Neerjola were compared in two seasons, summer and *kharif* 1969, to establish varietal differences and to elucidate causes for such differences in terms of yield components. CBE–X was found to be the best of all the varieties both in respect of grain yield (36 q/ha) and Stover yield (128 q/ha). The higher yield of CBE–X was associated with heavier ear, which in turn was consequence of more number of grains per ear. It also had higher leaf area and longer leaf area duration associated with medium net assimilation rate, resulting in higher rate of dry matter accumulation. The tall stature of CBE–X with comparatively more leaves contributed for higher stover yield.

Hybrids CSH–1 and CSH–2 were compared with their parents, *viz.*, IS–84, IS–3691 and MSCK–60, to explain hybrid vigour in terms of growth and yield attributes CSH–1 (46 q/ha) was the better yielder than CHS–2 (41 q/ha), and both of them possessed superior yield and growth components than their parents. Among the parents, MSCK–60 was a high yielder than others Incidentally, MSCK–60 had better yield and growth components. The higher leaf area of IS–84 and other better components of MSCK–60 seem to have reflected in CSH–1 and contributed for higher yield of CSH–1.

In another trial, CSH–1, Swarna and Neerjola were raised under two plant population levels, *viz.*, 1 33 and 1 ·77 lakhs per ha and at three nitrogen levels, 60, 120 and 180 kg/ha to study the differential response of these genotypes, both in respect of yield components and physiological growth components Hybrid CSH–1 gave significantly more yield (68 q/ha) than others. This higher yield was

a consequence of higher grain weight per ear, which itself was a result of more number of heavier grains. Further, it had higher crop growth rate due to high rate of dry matter accumulation and leaf area index. Population difference caused difference in individual plant performance. Lower population gave both better yield components and growth components, while at higher population only leaf area index and crop growth rate was higher. However, the yield per hectare was more or less similar. Significant increase in yield was observed between 60 and 120 kg per ha (61 q/ha), while at 180 kg/ha the yield increase was marginal (62 q/ha). Increase in the level of nitrogen, improved all the yield components. Only leaf area index was high at 180 kg/ha, but other growth components were better at 120 kg/ha of nitrogen.

In the defoliation experiment, it was found that complete defoliation at heading and 10 days after heading reduced the yield by 40 per cent and removal of 2/3 of each leaf and top half leaves also affected the yield appreciably. These studies indicated that the top leaves were more important than the bottom ones.

The moisture stress studies on Hybrid CSH–1, Swarna and Neerjola indicated that CSH–1 was better in withstanding the stress than either Swarna or Neerjola. While yield reduction in Swarna was 40 per cent, it was only 29 per cent in CSH–1. On an average the stress created upto wilting and 3 days after wilting reduced the grain yield by 27 per cent and 37 per cent respectively, compared to the control (17 q/ha).

Results of an experiment on the control of shootfly showed that the application of Phorate (10 per cent) at 37 kg per ha followed by repeated sprayings of Sevin (50 per cent W.P.) at the rate of 2 kg/ha upto 6 weeks, reduced the shootfly-incidence to a maximum extent of 95 per cent.

Improvement of Pulse Crops in Mysore State

To start with, the experiment on the "Seasonal variation in the yield of cowpea" was laid out. *Pusa Dofasli* and Local–K-1 were sown in 5 sowing dates at monthly intervals from May 20, 1970. Local K–1 performed better than *Pusa Dofasli* under all dates and with delay in sowing, pulse yield got reduced in both the varieties. The second experiment on N and P_2O_5 levels on cowpea varieties *Pusa Dofasli* and Local K–1 indicated response to only P_2O_5 upto a level of 10 kg per ha and there was no response for N applications. Twelve varieties of five different pulses were included in a study to compare their relative performance. Soybean variety, Improved *Pelican*, out-yielded (1,092 kg/ha) all the entries (328–628 kg/ha) There were differences between different pulse crops and between varieties within a pulse crop. Few greengram varieties were studied for their comparative yielding ability. Varieties BR–2 and No. 305 gave better yields in 1970, while No. 305 continued to be better in 1971 also. Cowpea varieties were

compared for their yield for two years. The indications were that Local C–1 (1695 kg/ha) and Local K1–1 (2,160 kg/ha) cowpea varieties were highest yielders. Among the varieties included in blackgram for varietal comparison in two years Khargaon–3 (525 kg/ha) and No. 1766 (672 kg/ha) were high yielders

Feasibility Studies on the Growing of Malting Barley in Mysore State

Experiments on the comparison of barley varieties were taken up simultanously under irrigated conditions at Hebbal and under rainfed conditions at Dharwar. At Bangalore, NP 104, a grain type yielded the highest and among the malting type *Betzes* gave the highest yield. At Dharwar, highest yield was obtained with the variety K–71. Different seed rates and spacings were tried on NP 104, a grain type and *Betzes*, a malting type at Bangalore. Increased seed rates produced more grain yield while increasing row spacing reduced the yield. Two malting types, *viz.*, *Betzes* and *Proctor* were subjected to different levels, forms, and times of application of nitrogen application at Bangalore. Among the sources of nitrogen, CAN produced more yield than ammonium sulphate and urea. Besides, increased yields were obtained with increasing nitrogen levels and split application of nitrogen was more beneficial than applying all at sowing in single dose. At Bangalore, barley varieties NP 104 and BG–1 were tried under combinations of different levels of nitrogen, phosphate and potash BG–1 yielded better than NP 104, and among nutrient combinations 80–40–40 kg per ha of nitrogen, phosphate and potash produced highest yield. At Dharwar, two levels of fertilizers were tried on varieties BG–1, EC 24882, NP 104 and *Betzes*. The fertilizer level 40–20–20 kg per ha of nitrogen, phosphate and potash gave more grain yield than 80–40–40 level. Among these varieties, NP 104 gave highest grain yield

Summary and Conclusions

In this paper the salient feature of the work carried out by the teaching staff of the Agronomy Department, Bangalore, in the last 25 years have been reviewed. The research works undertaken were primarily chosen from the standpoint of serving the needs of the farmer so as to provide him a better margin of profits. The notable features of the studies include introduction of new crops such as high yielding varieties of most of the cereals, pulses and oil seeds, evolving suitable cropping patterns and finding out the optimum water, fertilizer and agronomic management for the various crops of the region. As a result of sustained efforts, it has been possible to recommend sets of package of practices for different crops, based on research information gathered. In the recent planned approach, to solve the farmers' problems, interdisciplinary co-ordination is very much in evidence in tackling problem as a whole. The general attention of this Department is being directed to enhance and stabilize the yields and provide better returns to the Farmer

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Social Sciences in the Area of Agriculture in Mysore: 1946–71

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RESEARCH in the field of Social Sciences in relation to Agriculture is just emerging out of its infant stage in this institution. Twenty-five years ago when the Government of Mysore established the Agricultural College at Hebbal, there were no independent divisions or sections in the Department of Agriculture responsible for conducting research in the fields of Agricultural Economics, Agricultural Extension or Rural Sociology. The teaching positions were created to teach these three subjects during the years 1950, 1960 and 1965 respectively. However, the College of Agriculture, Dharwar, had a Post-graduate Programme in Agricultural Economics since the year 1950.

Till the establishment of the Farm Management Research Centre—as part of the Five-Year Plan schemes in the year 1959. research remained, a past-time for teachers or exercises for Post-graduate students It should be emphasised that the lack of understanding on the part of the administrative leadership about the role of the Social Sciences and the contribution it could make for agricultural development process, inhibited the growth and development of these disciplines till 1960. In fact, scientific approach to Agricultural Development process is yet to be seen in the policies and strategies.

Fortunately the leadership which was responsible for the development of Agricultural Universities at the Central and State levels recognised the urgent need to establish Divisions or Departments of Agricultural Economics and Rural Sociology, and of Extension education. The curriculum for the Agricultural Sciences now include Statistics, Sociology and Psychology as part of basic sciences and humanities as prerequisite besides the applied aspects of these in the fields of Agricultural Economics and Extension education.

The University of Agricultural Sciences, Bangalore, being an institution with an orientation towards integration of the three aspects of agricultural development process, *viz.*, the creation of knowledge (Research), the transmission of knowledge (Teaching) and the application of knowledge (Extension), has provided a great stimulus for teachers to devote part of their time for research whose objective is to find solutions to pressing problems. The research contribution of Social Science teachers during the recent five years has not only been considerable in proportion to the resources available but also has been in the direction of ploughing many new furrows. It is thus poised to grow much more rapidly in order to facilitate the application of knowledge not only quickly but also for profit.

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The review relating to research studies reported is presented under the following sections: Agricultural Economics, Rural Sociology, Extension Education and other studies.

Agricultural Economics

The early efforts were in the direction of understanding the general socio-economic conditions including the rural indebtedness and the role of private agencies in providing credit through village surveys (Balachowdaih, 1956)

A significant step towards the growth of Agricultural Economic Research was taken by the establishment of the Farm Management Research Centre in the year 1959. The specific objectives were (i) to examine the possibilities of improving allocation of resources and (ii) to identify and analyze specific improved farm practices. Some of the findings which have considerable extension potential (*Farm Management Studies in Bangalore*, 1963–65) were (i) Farmers can save 20 to 35 per cent of the cost by using the least cost combination of fertilizers. (ii) 'Punaji' Paddy cultivation around Bangalore results in a net loss of Rs. 5 whereas puddle cultivation results in a small gain of Rs 112. (iii) Productivity per rupee of investment on irrigation was as follows: Cabbage 9·53, Potato 7·27; Garlic 6·03; Onion 2·57; Beans 2·18; Chillies 1·82; Ragi 2·70 and Paddy 1·59. Combining capital and water efficiency, the preference for selection in Bangalore District was: Cabbage (Rs. 1,326); Onion (Rs. 539); Garlic (Rs. 480); Irrigated Ragi (Rs. 235), the return per acre being given in bracket. (iv) The comparative advantages of the water lifts revealed that Picota was the cheapest when water requirements were below 10 acre inches and advantageous when capital, land and bullock labour are limited while large supply of human labour is available. If the farmer is keen on meeting all this cost, the order of selection of water lifts would be pump, persian wheal, mhot and picota

Ervin J Long (1959), who was USAID Advisor in Agricultural Economics in the above Centre, demonstrated in a series of papers that analytical techniques help reveal many facts which otherwise would pass unnoticed and, further pleaded for research in the direction of producing production functions and substitution relationships to support development strategy. His illustration was that the results of fertilizer demonstrations in India showed increasing marginal productivity and the data for higher levels of inputs need to be obtained if production functions are to be produced.

H. A. Hendreson (1965), who was associated with this Farm Management Centre and later with the University of Agricultural Sciences, demonstrated the use of synthesis methods that use established knowledge to solve problems in addition to the analysis methods already used. Using this approach Krishnamurthy (1968) has shown that cost of slaughtering would reduce as the output

increased from 900 animals to 1,500 animals per day and recommended the operation of a unit of 1,800 animals per day resulting in considerable reduction cost per carcass. Using similar approach Baliga and Sridharan (1968) have worked out rainfall probabilities for different locations using rainfall data for 1897–1966 and suggested planting long duration Ragi during July and short duration Ragi during August to ensure maximum chances of getting the required rainfall.

V. Seetharam Sharma and M. B. Badanhop (1964) have provided exhaustive information on Grape enterprise in their publication entitled *Costs and Returns from Grape Production.*

Ramanna (1967) working on the yield responses of two potato varieties, using Cobb-Douglas functions, showed that P had greater effect upon the yield than N in case of Simla variety, while the reverse was true in case of Rickets, and at all levels of fertilization the estimated yields of Simla variety were higher than those of Rickets. In a study on the use and formation of capital on farms Ramanna and Chowdhuri (1969) indicated the possibilities of increasing production and productivity on all types of farms in the neighbourhoad of Bangalore City by augmenting working capital supply in the first instance and building up productive farm assets in due course and more particularly on capital starveds small or subsistence oriented farm indicating the special credit needs of farms under this category. They used linear programming technique in developing plans in this study.

More farm management studies are being conducted in recent years. One of the very significant contribution in this direction is the economic analysis of major irrigated crops in the Tunga Bhadra Irrigation Project which provides in sights on the question of efficient cropping patterns based on crop data from farmers under field operating conditions. It provides not only the detailed description of the input-out put and cost return relationships for the six subareas-crops/variety/season but also interrelationships between and among the data/ Further, it reports evaluation of (i) Competing crops (alternative) within given areas and for given seasons, (ii) the influence of the type of labour contracts on the costs of performing selected cultural operations and (iii) the economics of tractor *versus* bullock power. Such studies are urgently needed for all irrigation projects if the potentialities created are to be used to the maximum extent (Bisaliah and Taylor, 1971).

Another useful publication in the field of Farm Management arising out of available published and unpublished research and survey data is the 'Farm planning Manual'. And this includes budget for 32 crop enterprises and 3 animal enterprises (Nanjareddy *et al.*, 1971).

Several studies (*Progress of Research*, 1968, 1969) were reported in recent years evaluating the economics of high yielding varieties tried by the farmers. Profitability seem to be the most important factor influencing the farmer's adop-

tion of the high yielding crop or variety. For example, a comparative study of the cost of cultivation and the return in respect of Hybrid maize and potato indicated that net return per rupee of cost in maize was much higher than in potato (Rs. 2·36 for maize as compared to Rs. 0·99 in potato), although the gross and net returns per acre were higher in the case of potato (2·73 times that of maize). It was advantageous for the farmers with less money to go in for maize and still get higher rate of return. Again, Taichung-65 was not so popular as Hybrid maize and it was not found superior to local. Jalihal *et al.* (1969) have reported that this variety appears to be promising with moderate levels of fertilizers. Krishna Alwa and Jalihal (1971) attributed the farmers lack of enthusiasm for this variety to economic considerations Similarly, Taichung Native-1 did not impress the farmers However, I.R. 8 has impressed the farmers as regards the yield capacity compared to the local, both in Mangalore and Bangalore Districts. Srinivasamurthy (1971) computed that the I R 8 adopters doubled their net income by investing another 50 per cent to the operating cost of the local existing variety. Net return per rupee of additional cost was Rs. 4·33.

Ramanna *et al.* (1971) after conducting a detailed evaluation of the High Yielding Varieties Programme in Mysore State during 1968-69 involving 1,052 interviews in fifteen districts have reported the following findings: (1) The High Yielding Variety Crops in the State were raised by the farmers on 8·83 per cent of their sown area, and the adoption was relatively high among small farmers. On an average the large, medium and small farmers grew High Yielding Variety on 5·30, 2·81 and 1 81 acres respectively. (2) Farmers have obtained increased net returns for High Yielding Varieties over the existing varieties except in the case of Mexican wheat in which case comparatively very low prices were received However, district-wise comparative costs and returns for individual crops show considerable differences. (3) Ninety-five per cent of farmers applied fertilizers while only 59 per cent took plant protection measures which were more popular with the large size farms. (4) The grain quality of High Yielding Variety was "not acceptable" to only a very negligible number and at least 90 per cent of the farmers indicated that they would continue with the production of High Yielding Variety exceptions being paddy in Chikmagalur (72 per cent), hybrid maize in Bellary (59 per cent) and Mexican wheat in Dharwar (65 per cent). Thus the findings are very encouraging though the study did not involve analyses regarding the adoptoin levels regarding the recommended practices. Districtwise cost and returns for High Yielding Variety Crops are extremely useful to extension staff.

Production Credit has been universally identified as an essential accelerator of agricultural development and the Governments in India have been providing this facility for several years. An analysis of Institutional Financing of Agriculture which provides some insights into this programme has been attempted by Bisaliah *et al.* (1971). They concluded that adequate, purpose-oriented, timely and productively utilised institutional farm finance was what was necessary.

Agricultural development is not likely to be uniform and there is found to be a differential rate between the villages which have better communication and those who are isolated. Nagarajappa (1971) has worked on this problem as part of his M.Sc. Programme. His findings were that though there was no difference in the cropping pattern, the adoption levels differed and the levels of inputs and outputs for the main crops were different.

Thus, the research in the field of Agricultural Economics, which began in the early fifties as exercise for students and a pastime for teachers, gradually oriented its approach to the immediate farm problems and has thus contributed in no small measure to the creation of a source of information for extension use. The paucity of publication in this area is perhaps due to the lack of experimental data. As long as this lacunae exists, the agricultural economist has to rely on surveys. The use of sophisticated tools of analysis will not make the survey findings more reliable than the use of the data from experiments and field trials for his analysis. Ervin J. Long's pleading for research in the direction of producing production functions and substitution relationships to support development strategy have yet to be realized Nevertheless the extension agencies can profitably use the accumulated knowledge to oreint their development strategy at least for some selected enterprises for which reliable information is available and also to help their clientele to prepare more profitable farm plans. Thus every rupee invested by the State in the extension services can bring much better returns if they were to make use of the findings of the studies conducted.

Rural Sociology

Owing to the limitation of staff resources the work in this area is meagre. Whatever little there has been done has produced some significant knowledge. (*Progress of Research*, 1968–69). One of the field surveys (*Progress of Research*, 1968) has indicated that adoption of new farm practice was related to educational level, level of living, membership in organisations, size of farm, availability of irrigation, possession of a pump set, and income level. Both adopters and non-adopters indicated favourable attitude toward all the new Governmental Programmes involving social change, except for ideas related to caste. Both had about the same aspiration level as indicated by the ratio of income aspiration being twice as the present income.

Findings of a study of the activities, problems and responses of youth of a selected village involved in socio-economic changes were: Youth were not only aware of the new practices in Agriculture but also showed enthusiasm to improve their farms; elders have not taken care to mobilise youth to participate in development activity, youth regard education as a means of securing "Worldly wisdom" rather than a passport for job (Anonymous, 1968).

Another study related to the impact of rural legislation on socio-economic aspects of the rural people during the last one decade. Whose findings should serve as an eye opener to all who feel satisfied with passing of laws. Farmers were not aware of the various legislative measures; compulsory education act was not implemented, owner cultivators were not affected by the land reforms acts; majority were debters the source of credit being individuals/bankers and were not benefited by the Mysore Agricultural Debt Relief Act of 1966 (Anonymous, 1969).

Rural Sociology research though limited to these studies, has given a clear signal to the effect that whatever policy decisions involving 'Social Change' are made should be based on research information if it should have the potential for better implementation and desired result. The programme strategies to implement the policy decisions should be worked out after taking note of such research information. More than this, the studies have indicated that more of such studies are needed to guide many developmental programmes on hand.

Extension Education

The research efforts in this field have been directed towards elucidation of answers to such questions as what has been the response of farmers to the changing agricultural technology? How good has been the extension programme execution? Can the extension programme execution be effective, if it is based on 'theoretical principles of extension education ? Why recommended practices are accepted by some farmers earlier than others ? What are the reasons for some recommended practices being accepted by farmers while others are not? How do farmers use the information sources available to them ? The Knowledge accumulated while seeking answer to these questions is not only valuable but also amenable for application in the day to day extension work.

Diffusion of Research Information has been Slow

The study by J. H. Mecleod (1959) revealed that fertilizer use and other improved practices adoption was at a very unsatisfactory level, even though the research information was available for more than two to three decades. Another subsequent study (J. Srinivasamurthy, 1963) showed that 79 per cent of vegetable growers lacked knowledge on improved practices such as varieties, care of nurseries and use of fertilizers. Farm management studies (1963–65) also showed that only 11 per cent of paddy growers and 4 per cent of ragi growers were using fertilizers. Paddy is a crop on which considerable research information was available for a long time but yet the adoption level among the paddy growers of the Intensive Agricultural Programme District of Mandya was far from satisfactory Fifty-eight per cent used fertilizer as a top-dressing during 1960–61 with no basal application. The latest situation in this regard is in no way encouraging. Channegowda (1971) working on this aspect indicated that paddy farmers have not been keeping pace

with the advances in technology. His recommendations for improving this situation were (i) that blanket fertilizer recommendations be replaced with recommendations based on soil test and in relation to the quantity of farm-yard manure used by each farmers, (ii) plant protection schedule to be reviewed taking note of the economic aspect and (iii) the need for intensive studies on why farmers are not adopting the recommended package of practices. There seems to be considerable lag between research and farmers adoption.

Socio-Economic Status of Farmers may not be the Only Reason for Slow Diffusion

Evaluative studies on high yielding crop varieties have revealed that small farmers have tried and adopted these varieties though more of medium and high socio-economics status farmers have done so. Channegowda (1971) concludes that small farmers appear to be equally progressive as big farmers in the adoption of recommended paddy practices Ramanna *et al.* (1971) in their Statewide evaluation study found that the adoption of the high yielding crop varieties was relatively high among small farmers. J Srinivasamurthy (1971) stated that the medium and low social status farmers have adopted in considerable percentages, 44 and 53, respectively, the newly introduced I.R. 8 variety. Hence, the hypothesis that the general low economic level of farmers may be the major cause for slow diffusion may not hold good. There might be other important reasons for this situation

Extension Programme Execution may be Weak

A State-wide survey (Srinivasamurthy *et al.*, 1967) relating to the extension of Thaichung varieties of paddy brought out the weaknesses of the demonstration programme. In six out of the ten taluks included in the Survey, the field extension staff had negatively evaluated the potentialities of this variety because of the faulty Trial-*cum*-demonstrations which were established without following the full component of the recommended practices. Most of the farmers who had followed the recommended practices evaluated the variety not unfavourably. The study also revealed that even the few good demonstrations were not used for extension education activities. Jalihal *et al* (1968) in an analysis of the time spent by the field extension staff have stated that adequate attention was not paid towards educational activities like conducting field days, group meetings and demonstrations. This study points out that their time was spent in attending to the non-educational activities, to the visits made by Supervising Officers and other visitors and some of them were over burdened with other non-extension responsibilities.

Veerabhadraiah (1969) analysing the adoption of recommended practices in respect of Hybrid Maize cultivation around Bangalore brings out the fact that 85 per cent of the farmers did not use the recommended levels of fertilizers and the farmers cited the lack of adequate knowledge besides other reasons.

Dwarakinath *et al.* (1970) identified the lack of understanding of the significance of the recommendations for Hybrid Jowar cultivation as the barrier for adoping the practices in full. There were only 20 per cent of full adopters.

Byra Reddy (1971) revealed that adoption of fertilizer on rainfed ragi by farmers was significantly associated with their contact with extension agency. Wider adoption was not found because they lacked the needed extension contact. Jalihal *et al.* (1970) in a comprehensive study have concluded that the Panchayat Agricultural Production Plans did not promote efficient planning and execution of agricultural extension programmes and the field workers limited their activity to list out the requirements of inputs over looking the other important extension activities.

Srinivasamurthy (1971) has stated that follow up 'farm visits' by field extension staff to ensure better adoption level was unsatisfactory and the study revealed that the adoption level for the main crop of IR-8 was associated with 'farm visits' Such visits were found to be necessary to ensure better level of adoption. J. Srinivasamurthy and Krishnamurthy (1971) analysing the effectiveness of result demonstrations showed that educational activities around result demonstrations were lacking and the results of demonstrations were not used for wider publicity. Thus, it seems that the extension programme execution has not been as strong as it should be to promote rapid development.

Extension Programme Execution was Effective When Principals of Extension were Applied

Srinivasamurthy (1955) reported that well planned inservice training programme to assist the field workers in developing competence in employing effective demonstration programme, gave encouraging results.

Jalihal *et al.* (1970) have shown more adoption in the villages where intensive educational efforts were made by the extension department of the Agricultural College, Hebbal, Bangalore. The strategy consisted of the internal motivation to enlist demonstrator farmers and follow up with intensive educational efforts

Karamathulla *et al.* (1970) have reported that well planned and conducted visit to demonstration plot appreciably increased the knowledge of farmers about Hybrid Jowar cultivation.

An interesting experimental study by Ramakrishna *et al.* (1970) demonstrated that 'Programmed Instruction Method' can effectively assist the low achievement group of farmers in obtaining scores equal to that of high achievement group, as against the failure of the conventional lecture method. Further this technique can assist both the groups perform significantly better on difficult concepts.

Srinivasamurthy and Krishnamurthy (1971) comparing the relative effectiveness of result demonstrations established by using internal motivation and external motivation concluded that the former approach was twice as effective as the latter. The study points out many weakness of the present strategy of subsidised demonstration programme. Findings of Somasekharappa (1971) were that a combination of extension meetings, field visits to demonstrations and method demonstrations in a production-*cum*-demonstration session resulted in a better adoption levels as against the villages where these sessions were not held.

Shivakumar (1971) evaluating the U.A.S. advisory services stated that a well organised information unit with subject matter specialists as resource personnel can not only assist in providing needed information but also stimulate them to try the recommended practices. The same study also evaluated 'the farm visits' a co-ordinated advisory visits of the specialist staff and the field extension staff as a very effective programme. Besides the increased yield and income, the other gains from such 'farm visits' as identified by the farmers were the development of better decision-making capacity, improved farm management ability, an orientation in favour of taking risks and the increased innovativeness.

These studies should be sufficient to convince the administrators of development programmes that the agricultural extension programmes can become more effective and help greater percentage of farmers adopt new practices as well as promote better rate of diffusion if only the field extension staff is allowed to develop extension education activities based on the sound principles of extension.

Farmers Characteristic that Influence Early Adaption of New Farm Practices

It is well known that some farmers try and accept recommended practices earlier while others take more time. The reserach has explained this aspect farmers in the younger age group, with medium-sized holding, and some formal education, belonging to joint family of above average range economic status tend to adopt high yielding varieties rather than other categories of farmers (Dudhaniet Sethu Rao, 1969). Besides the first three characteristics mentioned above, the other important characteristics of farmers who voluntary to try an entirely new crop or a high yielding variety were member of local organisations, used mass media and possessed higher general adoption level in respect of agricultural enterprises (Srinivasamurthy, 1969; Veerabhadriah, 1969; Srinivasamurthy and Krishnamurthy, 1971; Shivakumar, 1971: Somasekharappa, 1971).

Comparison of characteristics of adopters and non-adopters with respect to fertilizer use on dryland, a practice involving overcoming of certain deep-rooted inhibition, was made by Byra Reddy (1971). Education, Social participation, media participation, contact with extension agency, larger holding and higher eco-

nomic status, higher general adoption level, and adoption of fertilizer for irrigated crop were the distinguishing characteristics of these adopters.

These conclusions suggest that in every community one can find farmers who volunteer to try new innovations and they can be utilized for providing adoption leadership and there would be no need to use external motivation such as subsidizing inputs—for demonstrations for extension educational process.

Characteristics of an Innovation Influencing the Adoption

It has been seen that profitability and relative advantage of an innovation exerts considerably influence Veerabhadriah, *et al*, 1970; Ramanna *et al.*, 1971; and J. Srinivasamurthy, 1971 investigated this aspect in greater depth while the other studies reviewed earlier provided indirect evidences. Opinion of farmers revealed that they disregard compatability factors like taste, marketing, straw yield and quality, greater susceptibility to pest and disease provided high profitabllity was demonstrated.

Somashekharappa (1971) found that Hybrid Jowar and Hybrid Bajra were not accepted by farmers when compared to Poorna Ragi, due to unfamiliarity with the crop. However, studies have shown that Hybrid Maize and Mexican wheat were accepted for trial by farmers when intensive educational efforts were made (J. Srinivasamurthy, 1967, V Veerabhadriah, 1969; J. Srinivasamurthy and H. Krishnamurthy, 1971). Unfamiliarity can be overcome by extension education. A scale for quantitative evaluation of the perceptions of the potential adopters toward innovations has been proposed by B. Krishnamurthy (1967). This is a welcome contribution for extension education use.

Farmers Sources of Information and Mass Media Use

While research knowledge relating to farmers sources of information and their relative influence in farm practice adoption can be ferreted out from many of the studies reviewed already, there were some studies where in attention was primarily focused on this aspect

Neighbours among the informal sources and the Gramasevak among the formal sources were the most utilized sources of farmers (Veerabhadriah, 1969; Ramanna *et al.*, 1971; Srinivasamurthy, 1971; Somasekharappa. 1971; Srinivasamurthy and Krishnamurthy, 1971; R. Dwarakinath *et al.*, 1971) The Gramasevak was the most common referrent followed by the Secretary of Co-operative Society among the formal sources (Veerabhadriah *et al.*, 1970) He was also rated high on the credibility scale in the non-progressive villages and equal to that of demonstrations while the progressive villagers reversed this rating. Demonstration and Gramsevak were the two sources which were rated high by the progressive villagers, when compared to other sources. Informal sources like local leader were rated high

over institutional and formal sources in the non-porgressive village unlike the progressive villages (Sethurao *et al.*, 1971). Mass media sources like radio and newspapers have received equal importance to that of leaders, relatives and friends among the informal sources (Dwarakinath *et al.*, 1970). They were identified as very important sources of information in addition to personal sources like neighbours, co-operative Secretary (Veerabhadriah and Sethurao, 1970).

However, investigations focused on ascertaining their specific role in the adoption of high yielding crops, revealed the mass media was found to be least utilised or having considerably less significant role (Veerabhadriah, 1969; Ramanna, *et al.*, 1971; J. Srinivasamurthy, 1971; Somasekharappa, 1971).

Majority of farmers who had higher social participation in an organization used formal sources and the farmers who had no social participation used informal sources. Majority of illiterate farmers utilised informal sources while literates utilised formal sources (Veerabhadriah, 1969).

Institutional and informal reference groups have not been referred to any considerable extent. Personal characteristics such as age, educational level and social participation influenced the selection of referent and reference groups. Even though 'leader' was not mentioned as an important informal source of information a study reported by Veerabhadriah *et al.* (1970) lists certain characteristics of most consulted leaders. They have received some formal education, occupy an higher economic status, hold certain formal leadership positions, have markedly high social participation and material possessions than that of least consulted leaders.

Farm broadcasts are being used to support extension education in recent years. Evaluation of the influence of this mass media is possible on the basis of some of the studies already referred to (Srinivasamurthy *et al.*, 1967; Veerabhadriah and Sethurao, 1970; Srinivasamurthy, 1970; B. Siddaramaiah, 1971; J. Srinivasamurthy and H. Krishnamurthy, 1970). The important findings from these were. All category of farmers were capable of understanding the ideas presented through farm broadcasts irrespective of their different backgrounds like age, education and intelligence. Great majority of radio owners in the rural communities listen to farm broadcasts and place higher preference over other entertainment programmes. Film songs and news bulletins were equally popular. Radio was perceived as an important source for new farm practice adoption by the rural radio owners and they attach higher credibility to radio broadcasts. They were generally satisfied with the present programme and preferred "dialogues" and "question and answer type". One important observation was that radio, along with the newspapers to some extent, has proved to be an effective direct communication link between research and innovator farmers, in a sense rendering the position of those field extension workers, who were not up-to-date with the developments or whose links with research were not effective, difficult.

For development administrators and directors as well as extension supervisors who might raise their eye brow when they read the term 'Extension Research' and ask what do you mean by this topsy tervy terminology? and without waiting for the answer state that the job of extension is to extend research knowledge and not engage themselves in research, the review in the preceding paragraphs should be informative. This set of 'action research'* that was reviewed has reliable research information for guiding action (extension programme execution). Many of the frustrations and failures in extension efforts and for that matter even in community development efforts, can be explained, if one takes note of the findings of the studies discussed. Small investment into action research of the type that was reviewed should make the bigger investments in development pay maximum profit.

Other Studies

Some interesting studies which might help in Agricultural development policy making have been reported. One of them relates to crop patterns (Sundararaj and Nagaraju, 1967). Applying the Pythagerean general distance concept for measuring the pattern similarities, they showed that the crop patterns for Mysore and for India, though very different sustained only minor fluctuations in the First Plan period and got stabilised by the Third Plan period. Further the patterns of fluctuations in the State did not bear any correspondance with that for India during the First Plan period, and moderate resemblances seemed to emerge out during subsequent plan periods.

Srinath and Ahalya (1968) analysed agricultural growth rates of areas, production and productivity of different crops in Mysore State using the concept of dividing '*b*', the regression coefficient by the harmonic mean. The data relates to the period 1952–65. According to this analysis rice has the highest growth rate, while maize has the highest growth rates of area as well as productivity

Madappa and Vijayamma, (1970) studied district-wise, land use pattern, cropping, intensity and the same are useful for policy makers.

In another study (Ramana Rao and Mohana Rao, 1971) on the monthly rainfall data of 45-selected stations spread all over Mysore State for June-October, state that in general the amount of rainfall a farmer can expect, with 75 per cent reliability was far below requirement of crops under rainfed conditions in all parts of the State except in the Malnad and Semi Malnad regions.

An interesting study (Krishnamurthy and Ameerjan, 1969) relating to the occupational preferences of Agricultural College students indicated that their preferences were in this order, cultivating one's own land, research work, and extension work in order. And the personal satisfaction and the challenge that

* 'Action Research'—research designed to guide the action Programmes.

a job offers were the primary determinants. Another similar study (Krishnamurthy *et al.*, 1969) has pointed out the need for intensive studies in the vocational preference by students the Agricultural Colleges These few studies provide us with illustrations of contribution of basic sciences and humanities to the agricultural development process More co-ordinated and planned research effort using such resources available can make the agricultural research more broad-based and can provide more careful information.

Conclusion

In conclusion it may be said that Research reports, papers and post-graduate students work in the field of Social Sciences in the past 25 years suggest that mere creation of knowledge and the transmission of the same to the students by itself will not establish a favourable situation for the application of such knowledge. Scientific analysis of the available research information (facts) undertaken by the Agricultural Economists and the use of this analytical findings in the formulation of extension programme strategies are essential for the effective application of knowledge. It is imperative to understand the economic and social implications of technical recommendations Further, extension programme execution whose only concern is the effective application of knowledge should be supported by 'action research,' if the execution has to be more effective than at present.

The status of research in this field has reached a take off stage to play a more vital role in directing the Agricultural development process. It is for the policy makers and programme directors of Agricultural development process to make increasing use of this branch of Science in their activities.

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Reminiscences from Alumni

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Occasionally, I look back on my past. Most of the time it is a sense of gratification that pervades. Of course, I have my share of regrets. But, on the whole, I feel surprised and even pleased about the way things have turned out for me.

What is it that looms large in my two and half decades of adult life? Without hesitation I can point to the Agricultural College at Hebbal. It gave me not only the knowledge and skills of my profession, but also a sense of direction and a depth of meaning to my whole life. Here lies my indebtedness.

For the first time, the college started its admissions in 1946. By then, perhaps, I had my predisposition for agriculture. I was at the end of my age of " unsettled attitudes". An active participation in the political movement of 1942 and a spell of jail life had thoroughly disturbed my orientation to education and future life. I was under some pressure to join the medical or the Engineering College, after my intermediate course. Neither of them was to my liking. It was at this point that I learnt about the Agricultural College. I readily saw my opportunity.

Even now, I remember some of the persuasive thoughts I had at the time. At this college, I argued, one could learn the marvels of life—of plants and of animals. Here, one could learn some ways of helping the humble farmers of our land. Probably, the fact that I come from a rural family that was passing through the stresses of the depression and the world-war also had its effect.

But, the real impact came during my college days. Retrospectively, I recognise three factors here The foremost was the faculty. It was a small staff, but a few of them stood out on our horizon. They were outstanding not so much for their educational attainment or scientific accomplishments On the other hand. they were remarkable for their human qualities They did not reach out for fame, nor were they terribly ambitious. All-the-same, in the limited sphere of our college life they did make a deep a lasting impression on each of us. I should refrain here from naming those few persons. But, nobody could miss their sincerity, earnestness and willingness to face the delicate problems of a new college. Nor could anybody help observing their commitment to certain values and their determination to abstain from using student problems to advance their individual goals. It was these personalities that filled some of the voids in my thinking, and answered some of my larger questions at the time.

The other factor was the student group. It was really a motley crowd, people coming from many walks of life. In that first batch of students more than half were already graduates in science. There were boys from rich plantations; some from poor agricultural families; and some from urban homes with no background in farming. For a dozen reasons, this collction could have been anything but a friendly group. Still, during those three years, there developed among these strangers an abiding brotherhood That itself was a glorious lesson in living together. In many different ways I benefited from these intimate associations

The third factor is my own reaction to this unique situation. On the academic side, I was able to turn a new page. Till then I was an average student, mostly in the middle of my class. But in the new atmosphere, I found a new impetus. Some early successes and the generous encouragement strengthened my self-confidence and fostered my interest in the subjects. At the same time, the gains on the personal side were also enormous. The long, lively discussions that marked the hostel life anywhere were a tremendous sources of general education. For, in that group were men with varied and serious interests, extensive scholarship and exceptional intellectual abilities. Thus, I found here vast educational opportunities both inside and outside the classroom, and both in professional disciplines and life-wide issues.

These were my formative days at the college. It was here that I made up my mind as to what things I should value more than others. For, it was here that I realised that a successful career may not necessarily mean a success in life.

Over twenty years later, I still feel that my college days were the crucial part of my life. They were the most enjoyable, too.

G. I. D'SOUZA,
Director,
Coffee Research Institute, Balehonnur,
(Mysore).

The earliest and most indelible impressions of Hebbal with me as also probably with most of my class-mates are the practical classes in manual transport of farm-yard manure, puddling and transplanting in paddy fields and preparation of sugarcane sets; the latter being enjoyable as we had a chance of devouring at least one out of every 5 sugarcane sets prepared for seed material. I still remember the rich taste of the Mysore *Pattapatti* cane and the succulence of CO 419.

Then came the Quit India agitation which dislocated our classes but only for a short while.

The sports activities under the guidance and inspiration of Mr. H. Shiva Rau comprised of cricket, Kabbadi and football and I represented the college in Kabbadi and still remember how sore I was after the matches.

The veterinary classes under Dr. Subramaniam were something we always dreaded —but the old vet. was a very stern disciplinarian who insisted on each one of us knowing the various parts of a cow in minute detail and other treatments like " drenching " and throwing a cow and puncturing the rumen in case of acute tympanitis. I must say that long after I left college, I had occasion to treat quite successfully a case of tympanitis and save a precious and cherished bovine life.

Looking back over these early formative years, I often imagine I still hear the stentorian voice of Mr. R. S. Iyengar, who was one of the most brilliant lecturers I have come across; the measured sonorous tones of the Entomology lecturer Mr. B. Krishnamurthy, and the precise and clipped deliveries of the Engineering lecturer Mr. Sree Ramappa and last but not least the eloquent lectures of Mr. Balachowdiah in Agricultural Economics.

Hebbal does not bear the old sylvan look anymore, but I still see the old Hebbal behind the new structures that have come up on the Campus and hope that the college which has been a source of inspiration for me will continue to inspire many for years to come.

B. L. GOWDA,
Ex-Deputy Minister for Co-operation.

I am very happy to know that the Mysore Agricultural College is celebrating its Silver Jubilee. It is really a welcome thing for every one who knows its activities and specially for persons like me who is one of its old students. I belong to the second batch of the College, having studied in it during 1947–50. I had the unique privilege of working in the *Mysore Agricultural Students' Association*, as its Executive Committee Member, Secretary and its President.

For those of us who were studying there during its beginning, it is really a development beyond recognition. I am glad to say that it has caught the imagination of the ryot by its extension activities. It has endeavoured to contribute towards the Green Revolution in the Country. I could with authority say it has carried technical know-how to the doors of the ryots.

G. N. ALASINGRACHAR,
Joint-Director of Agriculture, Raichur (Mysore).

It was a significant and memorable day when I appeared at the interview for selection to the Agricultural College. It was Dr. B. T. Narayanan, who by admitting me to the College, actually turned the corner in my life. The college was started in 1946 and the 30 candidates that were selected along with me are really proud of belonging to the first batch. These thirty who got admission were from out of the 600 and odd applicants.

After joining the College, it was really difficult for us to reconcile to the situation that obtained there, for there were no buildings commensurate with the title of the College. The buildings used by the Agricultural School had to be used by us. Since it was a residential College, we had to stay on the Campus. But hostel facilities were not adequate. However, the generosity of the students of the Agricultural School helped us to settle ourselves. To ease the situation, Government built some Nissen Huts similar to the ones found in army camps. Many of our classes were held in those sheds. Some of the students also had to be housed in such sheds for want of accommodation in the old hostel buildings.

Since the College did not have independent staff in many disciplines, most of the teachers were drawn from the Department of Agriculture on a part-time basis. They were experienced, highly qualified and competent teachers. There was a whole time Professor of Agriculture.

While the College was located at Hebbal about 5 miles from the city the laboratories of the department had to be used for practical classes which meant making a trip to the City each time in the omnibus which was practically a lorry with wooden seats.

Another very important and significant thing I remember is, the excellent staff student relationship we enjoyed and that is continued even to-day. One cannot forget Dr. B Dasappa, Professor of Agriculture with his usual paternal affection to each student Of course, Shri R S Aiyengar the living encyclopedia in Agriculture will be remembered by everyone of us. Mr. B. Sreeramappa with his immaculateness in dress as well as teaching lives in our memory and the knowledge in engineering he gave along with Mr. L. Krishnamurthy Rao, is still keeping me in good stead.

One cannot forget the good bunch of Entomologists we got associated with. Mention may be made of Mr. B Krishnamurthy with his discipline enforcement, Dr. M. Puttarudriah the everjolly entomologist with his rhetoric and Mr. D. Sheshagiri Rao with his Johnsonian English blended into Entomology.

Coming to the Agricultural Chemistry, I still remember the Chemistry Frontier Mail driven by Dr S. V. Govindarajan and his close associates Mr. B. V. Venkata Rao and Mr H. G. Gopala Rao who helped us very much with our practical classes. I am not able to forget the kindness received at the hands of Mr. B. V. Venkata Rao As a part of our course, we learnt Animal Husbandry and Veterinary and in this I remember Dr. N. S. Krishna Rao and Mr. Subramanyam whose teaching is still green in my memory.

While I would like to go on writing about each staff member, space does not permit this and so I end up by mentioning one practical and ever jubilant member of teaching staff and that is Mr. Venkatasubbiya whose teaching of mechanical engineering is helping me in every day life Likewise Dr. H. C. Govindu's lectures on taxonomy is ever remembered.

The Agricultural College Hostel during those days had the reputation of serving excellent food and we used to have lots of guests on every Saturday being the feast day. This helped bring about some very good associations with excellent persons

While the above description is only of the routine nature the quality of training I got is reflected in the development of competency I have been able to accomplish and the position I hold now. The stupendous growth the College has made during the years after the establishment of the university under the distinguished guidance of Dr. K. C. Naik, is amazing.

K. SHANKAR,
Regional Representative (S. India & Ceylon),
Technical Advisory Office,
VELSICOL CHEMICAL CORPORATION,
P.O. Box No. 153,
Bangalore-1, S. INDIA.

It was a bright sunny morning in September 1950, when my father took me into the Principal's room seeking admission to the first year of a three year Course leading to a degree in Agriculture. The building was nothing to speak of, but for the lone 'honge' tree, right opposite to the Principal's Office, offering a pleasant shade which was shared peacefully between the students and the staff.

Dr. B. Dasappa, the then Principal of the college, with a professorial elegance, impressed on us the benofits that I would get after graduating from his institution and did not let us out of his room till my father paid my admission fee. Thus, I became a student of the Mysore Agricultural College, Hebbal, Bangalore. The College started in 1946 and I was in the fifth batch.

The next morning, I moved into the Hostel. The Bangalore Transport Company was running one bus between Majestic and Yelahanka at intervals of two hours, during peak hours and at intervals of three hours in the afternoon. I was allotted accommodation in the Nissan Shed. There were three such sheds, arranged in the form of U with a basket ball field in the Centre. Two long sheds running parallel to each other, east to west, were a part of the hostel, allotted to new comers. The third shed between the two and running North to South, was the Chemistry Laboratory, but not in use at that time. For the practical classes in Chemistry, we were taken in the College, bus to the Departmental Laboratory situated in the Administrative building of the Director of Agriculture.

The College had an admission capacity for 48 students. In my batch, only 36 sought admission, 32 joined and four of them left after two months. We were 26 when we were promoted to second year, and 16 when we entered the final year. Twelve of us graduated in 1953. I secured the first rank.

At 18, I was the youngest student to enter the portals of the College. There was no ragging in the hostel—Agricos have always been Gentlemen. Mr. N. Chikke Gowda, who had joined the College a few days earlier, took upon himself to show me around the hostel and introduce me to the other boys. He even initiated me to the cultural centre of students' activity. This hub of student activity was Vasu's Hotel in Hebbal Town. After every theory class, we would eagerly adjourn to Vasu's for a cup of Coffee.

Working hours were uniform for all the three year classes three hours in the morning and three hours in the afternoon. Each session of the three hour academic exercise involved an hour of theory class, followed by a two hour practical course in the same subject

There was always an interval of half hour between theory and practical classes. The students were exposed to a mid-term and a final examinations at the end of an academic year. Only the final examination was taken seriously. I do not remember any one of us staying in the examination hall for more than half hour in the mid-term examinations. Traditionally, we did not believe in exercising our teachers and hence, we left very little for them to evaluate.

Teacher-student relationship was one of the best in the Country. We were like a family. It is therefore, with pride I mention a few of my teachers by name. M/s. D. Seshagiri Rao, M. Appanna, G P Channabasavanna; Dr. Puttarudriah and Mr. Krishnamurthy in Entomology; Dr. B. Dasappa, Mr. R. S. Iyengar and Mr. M Mallaraj Urs in Agronomy; Dr S V Govindarajan, M.. B. V. Venkata Rao and Mr. Bhimasena Rao in Chemistry; Dr. H. C. Govindu, Dr. K. S. Krishna Sastry and Dr. S. R. Chandrasekharaiah in Botany; Mr. Samuel Dhanraj and Mr. B Sri Ramappa in Agricultural Engineering, Dr. Srikantiah in Animal Husbandry; Mr. Venkatarayan in Plant Pathology, and finally, Mr Balachowdiah in Agricultural Economics. Some of these are still working in the University, many have retired and some have departed from this earth. These together with Principals like Dr B T. Narayanan, Dr P. H. Rama Reddy, Mr. M. Mallaraj Urs, Dr B. Dasappa and Mr. B. Venkoba Rao have worked hard and have built up the Institution to what it is today.

My active association with the College continued till 1962, where I was a lecturer in Agricultural Chemistry for about 8 years Time has since brought about changes to the College. It ranks as one of the best Agricultural Universities in the Country. But to me, it has been and always will be the same good old college.

K. K. MURTHY,

Director,
Mysore State Film Industry Corporation Ltd.,
Malleswaram, Bangalore–3.

To travel backwards into the past is a fascinating exercise because as the Kannada Proverb has it "the distant hills are always smooth". By virtue of the golden sheen that time puts on it, retrospection brings to the surface, only memories of the sweet and pleasant landmarks of one's journey through life, harsh disappointments being conveniently erased from memory. At the same time, there is always a tinge of wistful regret on account of many an act of omission and commission which we could always improve upon given the opportunity to reverse the passage of time.

It was in what may be called the 'formative' period that I joined the Mysore Agricultural College. It was then a part and parcel of the Mysore Agricultural Department, with the teaching and administrative staff drawn entirely from the Department. The College itself was, in a sense, an off-shoot of the Mysore Agricultural School started in 1913–14 by Dr. Leslie C. Coleman, with its unique record of having contributed progressive farmers and administrative personnel to the state for nearly half a century. The College was thus the proud inheritor of the sound traditions of the school with which were associated Stalwarts like Dr. B. Narasimha Iyengar, Dr. Kunhi Kannan, Dr. M. K. Venkata Rao, Dr. Venkata Rao, K. Badami, Mr. Gundappa, S. Kurpad and many others.

It was in the fitness of things that Hebbal became the venue of the Agricultural College; it is a stone's throw from the busy metropolis of Bangalore and has been the nursery of agricultural talent for nearly five decades. Hebbal was (and is) also the location of an Agricultural Research Station, where theory is transmitted into reality. The College was born in this hallowed spot in 1946.

When I sought entry into the portals of this Institution in 1951, the college had not yet developed an individuality of its own, as it were The imposing structures that now adorn the campus, administrative blocks, laboratories, auditorium, lecture halls, hostel blocks, etc., were simply not there and had probably not even been thought of. As the successor to the school, the college was content to be housed in whatever accommodation that was there. Thus, the old Vice-Principal's Office, said to be the first cement terraced building in Bangalore became our Principal's office and the Pongamia tree in front was the focal point for teachers' and students' gatherings alike

For Hostel blocks and laboratories, huge Nissen Sheds and other *adhoc* structures were put up and lectures were organised wherever a little covered space could be managed. This did not matter at all, we were a small compact lot and we trotted obediently behind our Lecturers in search of class rooms.

When I joined the college, Dr. B. Dasappa was the Principal and later Professor B. Venkoba Rao succeeded him. There was not that hectic competition for admission seen those days; Engineering and Medicine still held sway over student's minds and Agriculture was the Cindrella of College careers. I had therefore no particular difficulty in getting admission and once in, we were decidedly a family of teachers and students alike.

The whole-time staff members were few; the senior Lecturers in Agronomy, Botany and Economics were the only whole-timers, to my best remembrance. The others came all the way from the department. We, the students, were conveyed in two ricketty vans, probably picked up from War disposals, to the Chemistry laboratories of the Department for our practicals and back to the Hostels. Professor R S Iyengar, Dr. H. C. Govindu, Professor B Krishna Murthy, Professor B V. Venkata Rao, Professor N S Venkatakrishnaiah are among the many teachers to whom I owe a debt of gratitude for having moulded me into what I am to day.

To recaptulate, the Mysore Agricultural College in those pioneering days was a homely institution in homely surroundings, with a homely set of teachers who took a peternal interest in us and our future. It is a matter of pride and happiness to us, the earlier students that many of our contemporaries are now adorning seats of responsibility in the University of Agricultural Sciences. Thus, a certain continuity and agreeableness is evident in the lives of the Institutions as of individuals, races and species.

Thus out of the Mysore Agricultural College, whose early beginnings it was my proud privilege to witness, has sprung the Mysore University of Agricultural Sciences, the foremost in the country under the wise leadership of its Vice-Chancellor Dr. K. C. Naik. The Campus, the staff and student complex, the system of studies and examinations, have all changed beyond recognition.

But the old spirit and the old ideals which have been cherished since the early days of Dr. Coleman, remain.

It is a momentus and memorable event, the Silver Jubilee of the ALMA MATER. On this historic and proud occasion, I, with all my contemporaries and friends welcome this opportunity to convey our deep debt of gratitude to the MOTHER for her fostering of us and shaping us into what we are. I, with my friends, pray and hope that the Institution may rise to greater heights of glory and continue to shape and guide the destinies of many, many future generations.

I close this short note with an expression of grateful thanks to the Organisers of the SILVER JUBILEE for this opportunity given to me to express my gratitude to my ALMA MATER.

A. C. SHIVE GOWDA,
Coffee Planter.
Chandragiri Estate, Chikmagalur P.O.

I am happy to learn that a Souvenir will be published in connection with the Silver Jubilee Celebrations of the Mysore Agricultural College, with great pleasure I contribute my reminiscences about my stay and studies at Agricultural College, Hebbal.

I graduated from the Agricultural College, Hebbal, in the year 1953. The three years I spent for my studies in that College is a notable one in my student career while I was studying in that college there were only few students in my class and the total strength of the college was also very small. We

were knowing each other very intimately. Our Principal was Mr. M. Mallaraja Urs We were taught by very eminent and highly Qualified persons belonging to the Agricultural Department and to our college I can never forget the very cordial relations we used to have with our Professors and Lecturers. They used to know us intimately and always used to help us in our studies during our stay in the college. I always remember them with great respect and regard

While I was studying in that college, it was still under development and there were not much facilities like good Class Rooms, Laboratories, Reading Room, Library, Sports field, Hostels, Canteen, etc. I am happy to know that a great change has taken place in our college now and many many improvements have come about

I always remember the education tours we use to have in our college. They used to be very extensive and intensive We use to learn many things about the Practical aspect of growing different crops. It used to be a pleasure and a privilege to meet so many farmers and to hear from them about their ways of growing crops, the experience of their farming from the business point of *view* and about their way of life. We visited and some times used to stay in the various Agricultural Research Stations. where we learnt about various aspects of scientific farming including the lecturers from the highly qualified, specialised and authoritative persons in the several disciplines We learnt a good deal about our subjects in our Educational tours The Professors and Lecturers used to be very strict during the days work and after that they were very friendly and mixed freely with us They looked after us well during our tours. There used to be lots of fun, games and matches during these hours. I still remember the day when my class mates and my professors visited my coffee Estate near Chikmagalur during one of the class tours It was a great pleasure for me and for my family members to have played host to them. Once in a while, when I go through my photo Album, I remember the days I spent in our class tours and in the college.

I still remember the quite, peaceful surrounding of the college which was ideally suited for studies. The little village of Hebbal typical of Indian Villages was really small and it contributed richly towards the usual setting of the Agricultural College.

I am very happy that our college has become a constituent College of the University of Agricultural Sciences since 1965, and facilities for doing M.Sc. and Ph.D., in various subjects have been created It is a pleasure to note that emphasis has been given to teaching, Research and Extension aspects of Agricultural Sciences. I wish that our college will grow from strength to strength, and help the students in their quest for knowledge in the field of Agriculture.

Y. K. S. MURTHY,

Head, Division of Fermentation Development

22, VIA E. DE NICOLA
TORRE DEL GRECO (Napoli)
ITALY

It is a great pleasure and honor to have this occasion to express my reminiscences about my alma-mater. Twenty-five years have rapidly slipped by and for many of us who belonged to the very first batch of students, it is a proud moment to take part in the 25th anniversary celebrations. I remember vividly the conditions that were existent in 1946 and during my last visit to Hebbal in 1969, I was pleasantly astounded at the progress the institution has made. It is needless to state that this progress is the result of a co-ordinated work of able dedicated administrators and the active participation of student population. It certainly is a major achievement to transform an Agricultural College to an Agricultural University providing both undergraduate and graduate training in multidisciplinary aspects of Agriculture. I am proud to have associated myself with such an organisation and on this happy occasion, I wish the institution all the best. I also take this opportunity to wish all my friends and colleagues who are presently guiding the institution, either as professors or administrators, a continued success and I eagerly look forward when I could have another occasion to visit Hebbal.

AGRICULTURAL COLLEGE, HEBBAL
BANGALORE-24

ROLL OF HONOUR

YEAR		NAME
1949	..	ALASINGRACHAR, G. N.
1950	..	D'SOUZA, G. I.
1951	..	THIPPE SWAMY, S. C.
1952	.	KEMPANNA, C.
1953	..	SHANKAR, K.
1954	..	BASAVANNA, H. M
1955	..	MAHADEVA SASTRY, K. S.
1956	..	JAIN, S. C.
1957	..	ABRAHAM, C. C.
1958	..	IYENGAR, G. S.
1959	..	GOPALAKRISHNAN NAIR, K.
1960	..	BALASUNDARA NAIDU
1961	..	NAGARAJAN, K.
1962	..	VISWANATH, A.
1963	..	ASOKA SRINIVASAN, G. S.
1964	..	EARNEST DHANARAJ, R.
1965	..	APPAIAH, K M.
1966	..	SIDDARAMAPPA, R
1967	..	SATHYANARAYANA MITHYANTHA, M.
1968	.	THOMAS JEFRY REGO
1969	..	(1) MRUTHYUNJAYA (2) RAMALINGE GOWDA, S. K.
1970	.	PONNAPPA, B. P.

New Scheme—1970—Trimester Set Up

1970	..	VASUDEVA RAO, M. J.

1971—Gold Medalist

1971	..	SUBRAMANYA, B. V.

LIST OF GRADUATES GRADUATED FROM AGRICULTURAL COLLEGE, HEBBAL, BANGALORE-24

MARCH—1949

1. Abdul Azeez Dastagir
2. Alasingachar, G. N. (*First Class*)
3. Anantharajaiah, R.
4. Anke Gowda, K.
5. Basavaiah, P.
6. Chandrasekhar, Y.
7. Chaluvarangan, D.
8. Dwarakinath, R. (*First class*)
9. Ghouse Mohiyuddin
10. Gopalakrishnan, C.
11. Krishnaswamy Rao, K.
12. Linga Rajan, G. M.
13. Murigeppa Shresty, D. S.
14. Nanjundappa, B. J.
15. Narasimhaiah, N.
16. Putta Naik, H. V.
17. Putta Ram, A. S.
18. Ramanuja Sharma, M. V.
19. Ranganatha Rao, B.
20. Singra Iyengar, M. A.
21. Shivappa, K. S.
22. Srinivasa Murthy, J.
23. Srinivasa Murthy, Y. K
24. Srinivasan, M. A., (*First class*)
25. Subba Rao, A.
26. Thimme Gowda, R. K.
27. Thimmaiah, T. M.
28. Venkataramaiah, B. P.
29. Vijendraswamy, R.

MARCH—1950

1. Abdul Jaleel, M.
2. Abdul Rahim Khan, K
3. Anandaswamy, B.
4. Chandrappa, B. K.
5. Chikkappa, G.
6. Dawson, M. J.
7. Doddahalappa, K.
8. D'Souza, G. I. (*First Class*)
9. Eswarappa, H.
10. Ganapathy, K. R.
11. Gowda, B L.
12. Hombe Gowda, H.
13. Karibasappa, B. K.
14. Kariyappa, H.
15. Kempe Gowda, B. K.
16. Krishna Setty, K. S.
17. Lalamayen
18. Mallashettappa, T S.
19. Mallikarjunaiah, B
20. Mohamed Ataulla
21. Nagaraja, A. N.
22. Nanjunda Reddy, S.
23. Narasimhaiah, C.
24. Narasimha Murthy, M. V
25. Narayan, B. V.
26. Narayan Prasad, H. D.
27. Rajasekhara Setty, T.
28. Ramakrishna, R. V.
29. Simhadri, R.
30. Sreekantaiah, K. N.
31. Sreekantaiah, K. R.
32. Subbaiah, K.
33. Subramanya Chetty, R.
34. Swamy, M. C.
35. Thimmaiah, G.
36. Thontadarya, G. S.

MARCH—1951

1. Basavaraj, K. M.
2. Bheemappa, T.
3. Gurushanthappa, D.
4. Hanumantharaya Setty, K. G.
5. Ibrahim Saheb, P.
6. Krishna Murthy, H. K.
7. Kasturi Rangan, K.
8. Leo D'Souza
9. Linganna, S
10. Mallesh, G.
11. Nagaraj, T. R.
12. Gurusiddaiah, D. M.
13. Nagasundara, F. G.
14. Naraharı, M.
15. Narasimhaiah, D. S.
16. Nagaraja Rao, S. A.
17. Puttaswamy, G. S.
18. Ramaiah, V. (*First Class*)
19. Ramanna, R.
20. Rangasetty, H. T.
21. Ramachandran, K. S.
22. Shabbir Ahamed Khureshi
23. Shamanna, S.
24. Shankaranarayana, M. S.
25. Subraya, M.
26. Shama Rao, H. K.
27. Taranath Bhagath, K.
28. Thippeswamy, S. C. (*First Class*)
29. Vasudevaiah, R. D.
30. Veerakyathaiah, V. D.
31. Venkatachala Setty, K. V.

SEPTEMBER—1951

1. Channaraj Urs, M. C.
2. Nagaraja Rao, S.
3. Narasimha Murthy, K.
4. Sampathu
5. Sundar Raj, M. N.
6. Veerappa, N.

MARCH—1952

1. Alasingachar, S. R.
2. Ananthaswamy, B. S.
3. Basavaraj Urs, L.
4. Gangappa, D.
5. Gurushanthappa, M.
6. Hanumantharayappa, N. T.
7. Kempaiah, K.
8. Kempanna, C.
9. Keshava Murthy, B. S.
10. Lingaiah, M.
11. Maralappa, R.
12. Nanjundaiah, H. R.
13. Panishayi, G.
14. Ramakrishna Reddy, M.
15. Sethu Rao, M. K.
16. Shankaranarayana, H. S.
17. Sreerama, M.
18. Srinivasaiah, A.
19. Syed Ahmed
20. Thontadarya, T. S.
21. Venugopal, M. S.
22. Yaraguntaiah, R. C.

SEPTEMBER—1952

1. Ananda, H. B.
2. Chandrasekhara, N. S.
3. Dattu Rao, D.
4. Kotrabasappa, C.
5. Krishna, A. V.
6. Mukunda Raj, V. K.
7. Murigeppa, H.
8. Raju, L.
9. Sathyanarayana Setty, H. R.
10. Seshadri Iyer, A.
11. Veeranna, M. S.

MARCH—1953

1. Archiebald Vas
2. Abdul Latheef, M.
3. Abdul Basheer, T. A.
4. Benakappa, D.
5. Janakiram, A.
6. Krishna Iyengar, N. S.
7. Kempaiah, S. K.
8. Manchappa, S.
9. Mallappa, M.
10. Rajendran, V.
11. Ramappa, B. S.
12. Shankar, K.
13. Shive Gowda, A. C
14. Umapathy, M.
15. Vasudevan, C. K.

SEPTEMBER—1953

1. Chandrasekharayya, H. V
2. Gopala Rao, H. S.
3. Siddalingaswamy, P.
4. Aprameya, V. N.
5. Patel, N. C.
6. Siddalingappa, K.
7. Jayatsan, C. S.
8. Mohamed Hussain
9. Jayaram Kamath, M

APRIL—1954

1. Basavanna, H. M. (*First Class*)
2. Chandraiahchar, M.

3. Chikke Gowda, N.
4 Chowdaiah, H. D.
5 Garudachar, B. S.
6 Kasi, R. S.
7. Kenchaiah, B.
8 Krishna Kanth, B.
9 Krishna Murthy, K.
10. Krishna Murthy, Y.
11 Narayana Reddy, P.
12. Rajasekhara, H. P.
13. Sathyanarayana Rao, N. S.
14. Srikantaiah, B.
15. Venkata Rao, S.

SEPTEMBER—1954

1. Ahobala Rao, K. R.
2. Ganapathi, K. V.
3. Ganganna, G. S.
4. Keshava Iyengar, A. R.
5. Lakshminarayana Setty, P R.
6. Makhdoom Hussain, H. S.
7. Muniswamy, Y. R.
8. Ramachandra Rao, D.
9. Ramaswamy, A. S.
10. Sanne Gowda, S.
11. Seetharamaiah, P.
12. Sreenivasa, K.

APRIL—1955

1 Hali, R.
2. Madhusudhana, M. V.
3 Mahadeva Sastry, K S.
4. Muddappa, B. P.
5. Ramachandran Nair, V.
6. Ramaseshaiah, G.
7. Sampath Kumaran, C S.
8. Seshadri, G. R.
9 Shantharajan, B. P.
10. Siddalingappa, C.
11. Surendra Prakash Marwaha
12. Thippe Rudraiah, H
13. Yellappa, V.

SEPTEMBER—1955

1. Basavaiah, M.
2. Khandoji Rao
3. Nanaya, K. A.
4. Prabhakar, D.
5. Rama, N.

MARCH—1956

1. Alexander, V. A.
2 Amanulla Khan
3. Ananda Alwar, N.
4. Basavaraju, T. R
5. Chandrasekhar, B. K.
6. Chandrasekharan Nair, K.
7 Chandrasekhara Rao, M. R.
8. Devaiah, M M.
9. Ganapathy, P. M.
10. Halappa, P.
11. Indravadan P. Shah
12 Isidore, A.
13. Jacob, K. J
14 Joseph, A. K.
15. Kempe Gowda, B.
16. Lingaraj Urs, C
17 Madanamohana Chandra Rao, V.
18 Mallaiah, A. B.
19 Mruthyunjaya, B. C.
20 Prahallada Rao, A.
21. Prahallada Rao, B. S.
22. Pushpagandan, K
23 Rajagopala Pillai, K. P
24. Ramanath, C. K.
25 Sankar, P. S.
26. Satish, S.
27 Shiva Murthy, S. C.
28 Siddaiah, K.
29 Sunka Reddy, N.
30. Swami Rao, S.
31 Swaroop Chandra Jain
32. Thekakara, J. I P.
33 Thimmaiah, K. W.
34 Thomas, J. M.
35. Viswanath, K. H.
36 Visweswarayya, K. N.

SEPTEMBER—1956

1. Abraham Philip, C.
2 Gopinath Rao, H. K.
3 Gopinath, K.
4. Mahadevaiah, K M.
5 Parameshwarappa, K.
6. Perumal Raj, B.
7. Ramachandra Naidu, B.
8 Rangaswamy Iyengar, F. R.
9 Sreekanta, H.
10. Thamaya, M. M.
11. Zacharia, C G.

MARCH—1957

1. Abraham, C C.
2 Achaiah, K. M.
3 Chandrakeerthy, P. N.
4. Chandrappa, A. P.
5. Chako, P. C.
6 Devaraj, M. J.
7. Gajaraja, C. P.
8. Gopinathan, K.
9. Jacob, C. I
10 Jayanna
11. Krishna Murthy, R.
12. Krishna Rao, J K.
13 Lingaraj, D. S.
14 Machaiah, P. P
15. Made Gowda, C.
16 Mohaboob Ali
17. Maruthi Rao, K. H.
18 Mare Gowda, M K.
19. Narasimhan, K. S
20 Narasimhaiah, V.
21 Narayana, M R.
22. Narayana Reddy, R.
23. Nagaraja, D. N.
24. Patric Tauro
25 Prahallad, S
26. Puttadase Gowda
27. Puttaswamy Gowda, B. S.
28. Ramadas, K. S.
29. Ramanna, M S
30. Rajanna, B.
31. Sampath Kumar, B.
32. Sathyanarayana, M. K.
33. Shamanna, G.
34 Shambulingappa, K. G.
35. Shivanna, M
36 Sidde Gowda, B.
37 Srinarasimha Sastry, K. R.
38. Thomas, K. M.
39 Thomas, V.
40 Veeresha Gowda, G. K.
41. Venkataramu, K.

MARCH—1958

1. Abdur Sub, P.
2 Aiyanna, B. C.
3. Amjad, S. R. M.
4. Ananthaswamy, T. S.
5. Anjaneya Reddy, P. S.
6. Bharathavarma, K. R.
7. Bhaskara Panicker, T. K.
8. Bore Gowda, B.
9. Chandrasekharaiah
10. Dwarakanath, S.
11. Eswara Murthy, L.
12. Eswarappa, M. B.
13 George John
14. Gundappa, K. S.
15. Gururaja Rao, H.
16. Iyengar, G. S.
17 Jambiah, P.
18. Jayanna, M. T.
19 Kamalakanth, N.
20 Kavalappa, B. N.
21. Kempanna Gowda, B K.
22 Krishna Murthy, H.
23. Kushalappa, A. D.
24. Kyathe Gowda
25. Mallikarjunaiah, K G.
26. Muthanna, K. A.
27 Nanjappa, C. K.
28. Nanje Reddy, C.
29 Narase Gowda
30 Narasimha Murthy, K.
31 Narayana, M.
32 Onkaraiah, K. M.
33 Parameswaraiah, G.
34 Parameswarappa, S.
35 Ponnappa, K. M.
36 Rajagopal, T S.
37 Rajagopal, V.
38 Ramalinga, B. M.
39 Ramappa, N.
40 Rami Reddy, D.
41 Ramaswamy, K.
42 Revaiah, G R.
43. Sangappa, H. K.
44. Santhanam, G. D.
45. Sasikumar, T. V.
46 Shamasundar, A.
47 Shivalingaiah, D.
48. Shivaji, K.
49. Shiva Murthy, H.
50 Shivappa, K.
51 Shivashankar, G.
52 Srikanta Swamy
53. Subbaiah, P. P.
54. Subba Rao, A.
55. Subba Reddy, M. R.

56 Subramanyam, K. N.
57 Suryanarayana Sastry, K. S.
58. Thimme Gowda, B G
59 Varadiah, L.
60 Vasudeva Rao, K
61. Vasudeva Rao, K. R.
62 Venkataramanappa, M R.

SEPTEMBER—1958

1. Ananthanarayana, K.
2 Bevuru Gowda
3. Brahmasurayya, G A.
4. Chinnappa, I K.
5 Devaraj Urs, K. C.
6. Gangadharan, K.
7. Mallesha Gowda, A M
8. Moganna Gowda, L. C.
9 Sanjeevaiah, B. S.
10. Shanthappa, P B.
11 Srikanta Iyer, K. N
12. Sudarshana Rao, A. N.
13 Thimmaiah, G.
14 Venkate Gowda, M. K

APRIL—1959

1. Achaiah, C S.
2. Anantha Das, A. M
3 Annaiah Setty, T.
4 Annayyappa, K. V.
5. Ayyappa, M K.
6 Aswathaiah, B.
7. Basavaraj, S C.
8 Bhaskar Rao, Y.
9 Bylanarasaiah
9 *a*. Cariyappa, K. A
10 Chandrasekhara, B.
11. Chandrasekharappa, B
12 Chikkasubbe Gowda, S.
13 Dase Gowda, G.
13 *a* Godavarma Raja, P. G.
14 Gopalakrishna Nair, K.
15. Gopalaswamy Setty, K
16. Govindappa, D.
16 *a* Govinda Reddy, S
17 Halappa, G.
18. Hanumanthachar, H R.
19 Hanumanthappa, S.
20. Jagadishchandra, B. K.
21 Jagannatha, D R
22 Jayaram, B.
23. Jayaraji Gowda, D
24 Jayarama Reddy, P. A
25 Jogaiah, S.
26. Kamalaksha, S. V
27 Kenchanna Gowda, S K.
28. Krishna Murthy, H. S
28 *a* Krishna Murthy, K.
29. Krishnappa, H P
30 Krishne Gowda, J V.
31. Lakshmanaiah, T M
32 Linge Gowda, B K
33. Lingamuthu, I.
34 Mahaboob Ali Khan, H. S.
35. Mallari Bhat, B.
36 Manche Gowda, D.
37 Manjunatha Udupa, K.
38. Mahamed Ataulla, H.
39. Mayanna, G. V.
40 Mathias, T.
41 Nagabhushana, S R.
42 Nagaraj, M. A.
43 Nanja Reddy, B. V.
44. Narasimha Reddy, M. K
45 Narayana Swamy, B. C.
46 Papanna Gowda
47 Parameswarappa, G. N
48 Parameswarappa, R.
49 Parashiva Murthy, A. S.
50 Pilla Byrappa
51 Prahlada Rao, A.
52 Prakash, H S.
53 Rajasekhara, K.
54 Ramachandra Reddy, H.
55 Ramakrishna, H P.
56 Ramaraje Urs, N V.
57 Rudrasetty, T. M.
58 Sadasivaiah, R. S.
59 Sadasivaiah, T.
60 Sampangi, N.
61. Sangamanath, C.
62 Seetharama Reddy, H. K.
63 Seetharama Sharma, V.
64 Sharanappa, V
65 Shashikumar, M N.
66 Shivaiah, K.
67 Shivaiah, K M
68. Siddappa
69 Siddappaji, C
70 Shivalingaiah
71 Siddaramaiah
72 Siddaramaiah, V. K
73 Shivaiah, K. M
74 Sivaraman, S
75. Somasekharan, M.
76 Some Gowda, B. C
77. Sudershan, V. K.
78 Suryanarayan Prasad, N. K
79 Venkata Rao, B.
80 Venkatappa, B N.
81 Venkataswamy, R.
82 Visweswara, N S
83 Vittal, N. A

SEPTEMBER—1959

1 Abdul Khalak
2 Boraiah, S
3 Chandrasekhara, B.
4 Devadhanappa Gowda, H V.
5 Gopalakrishnaiah, L
6 Govindappa, M. H
7 Jagannath, M L
8 Mari Gowda, P.
9 Narayana Swamy, A.
10. Puttaraje Urs
11 Puttaswamy, D. K.
12 Prakash, S. V.
13 Ramachandraiah, H B.
14 Ramakrishna, K
15 Sangaiah, M
16 Seshala Rao, K R.
17 Seetharama Iyengar, M N.
18 Sreepada Rao, B. S
19. Sundareswara Rao, N L.
20. Siddaiah, S.
21. Somasekar, B. C.
22. Shivarame Gowda, B.
23. Sitaram, K.
24 Subbe Gowda, C. D.
25. Thimme Godwa, D. B.

APRIL—1960

1. Ananda, B
2 Annaji Rao, B. R.
3 Balasundara Naidu
4. Basappa, S. C.
5 Bore Gowda
6. Channamallappa, H.
7 Erappa
8. Ganesh Kumar, B. S.
9 Girish, K. G.
10 Gopal, J. C.
11 Gopalakrishna Nair, V.
12. Gopala Reddy, M.
13 Gayavadana, P V.
14. Jambanna
15 Jayaramaiah, K. M.
16 Krishna Murthy Bhat, P.
17 Lakshmana, A C.
18 Lakshmikantha Reddy, S. R.
19. Madappa, K K.
20 Madhavan, H P.
21 Madhu Raj, K. K.
22 Mahadevaiah, S.
23 Mahadevappa, M
24 Mallappa, M. B.
25 Marikotrappa, R
26 Marulasiddaiah, M. V.
27 Mune Gowda
28. Nanayya, N A.
29. Narasimha Murthy, H.
30. Narayanappa, G N.
31 Pundarika, B.
32 Puttaswamy, T.
33 Raghu Mohan, N. G
34 Raja, T
35 Ramakrishna Reddy, N.
36 Ramamohan, B. N
37 Rama Murthy, A.
38 Ramaswamy, K.
39 Ramaiah, K.
40 Renukaradhya, B. N
41 Riza Ahmed Sherieff
42 Rudrappa, S V.
43 Sadashiva, T. V.
44 Sadashivaiah, A. S.
45 Shivanandaiah, M. P.
46 Skariah, P V.
47 Srirangaiah, M
48 Srikantaiah
49 Vasudevan Potti, P.
50 Veerappa, N G.
51. Venkata, S
52. Yellappa Reddy, A N.

SEPTEMBER—1960

1. Basavaraju, T.
2. Budyappa, K
3. Cyrill, A.
4. Dasappa, C
5. Devaraju, C.
6. Gopinatha Rao, H.
7. Gururaja Rao, B.

8. Hanume Gowda, G. H.
9. Kalaiah, G.
10 Krishna Murthy, K. S
11 Kusumakara, C.
12 Madhu, N
13. Nanjundaiah, S. V.
14 Narayana Setty, A.
15. Nemirajaiah, H.
16 Ramaiah, B
17 Ranga Rao, T. R.
18 Rudrappa, N.
18 *a*. Rudraiah, S.
19 Sachidananda, T. S.
20. Sanna Marappa, M.
21. Shambappa
22. Shivananoappa, N
23 Siddaiah, A C
24 Sadashiva Murthy, S.
25 Sampath Kumar, S. N.
26. G Virupakshappa

APRIL—1961

1 Adaviswamy, H. T.
2. Ananthapadmanabha Rao, P.
3 Basavaraj, V.
4 Bomma Gowda, A
5. Byra Reddy, H. N
6. Chandrashekar, G S.
7. Chandrasekharaiah, M. N
8. Channe Gowda, M B
9 Chikkachowde Gowda, C
10 Ebrahim Shah, M
11. Ganesh, P. M.
12 Govinda Reddy, B T.
13. Gowda, P L.
14 Gurumurthy, P. Y
15. Jagannath, B.
16 Joseph Basavaraj, D
17. Kempe Godwa, Y. S
18 Kempaiah, Y C
19. Kenchaiah
20 Krishna
21 Krishnappa, P V
22 Lakshmana, E.
23 Lingaiah, K
24 Lokappa, B.
25 Mallappa, A C.
26 Mallinath, H R.
27 Mari Gowda, B. S.
28 Marens Correa
29 Muralidhara, K
30 Nagarajan, K.
31 Nagaraja Setty, M. V.
32 Parvathappa, H C.
33 Pancha Murthy, R.
34 Rajashekara, B. G
35 Rajashekharaiah, S.
36 Rajashekaraiah Reddy, R
37 Ramanathan, G.
38 Ramappa, A.
39 Rangadas Shetty, H. V.
40. Ranganathaiah, K G.
41 Rangenath Sastry, K. N
42 Ravindra Nair, C K.
43 Sadashivappa, G. H.
44 Sanna Rajegodwa, S K.
45. Seshadri, V S.
46 Shankara Murthy, H. G.
47. Shivalingaiah, B.
48 Siddappa, P.
49 Sreenivasaiah
50. Sriram Shetty, K.
51 Subramanya, T D.
52 Shankare Gowda, B. T
53. Shivappa Shetty, K.
54 Shivaramaiah, K. B.
55. Shivananje Gowda, K N
56. Shivarudraiah, C
57 Somashekara, C M
58 Subba Raya, R. N.
59 Swamy, M C.
60 Thammaiah, P
61 Varadaraju
62 Veeraraja Urs, Y. S
63. Vishakantaiah, M.
64. Zainulladdeen

SEPTEMBER—1961

1 Bette Gowda, B.
2. Lakshmanaiah, D. V
3 Nagaraja, G
4 Rama Reddy, M. T.
5 Ramakrishne Gowda, V.
6 Syed Nisar Ahmed
7 Venkataram, J V.

MARCH—1962 (NEW)

1 Achayya
2 Anandachandra Kumar
3 Kumara Swamy, G. H
4 Lakshminarayana Setty, S K.
5 Mohamed Refeulla Delvi
6 Nazeer Ahmed, H
7 Raghunathan, R.
8 Ramachandrappa, B K
9. Ranganatha Rao, K.
10. Sampath Kumar, M
11 Shankara Rao, K S.
12 Suryanarayana Maiya, U.
13. Swamy Rao, T
14 Uthappa, K.
15 Vasanth, K P.
16 Venkataraman, V
17 Viswanath, A.
18 Yeshawantha Simha, K

MARCH—1962 (OLD)

1 Balaram, B
2 Basavanyappa, K G
3 Chakrapani Gowda, H L
4 Chandrashekara
5 Chandrashekara, S. T
6 Disle, M H
7 Doddaiah, H
8 Doraiswamy, T P
9 Ganesh, S
10 Gopal Naik, D
11 Gundu Rao, M R.
12. Hanumanthappa, S
13. Hanumantha-rayappa, G N.
14 Hanumanthaiah, B H
15 Javaraiah, M.
16 Kale Gowda, K
17 Krishnappa, K
18. Krishnappa, M.
19 Mahadevappa, K.
20 Malathesha, M. H.
21 Mir Amanulla
22 Muddalinge Gowda, N. A.
23 Munishamaiah
24 Mruthyunjaya, G M.
25 Nanje Gowda, H.
26 Narayana, S. L.
27 Narayana Swamy, V. D.
28 Rajappa, M G
29 Raju
30 Ramaiah, R.
31 Ramalinga Reddy, P.
32 Ranganath, Y N.
33. Rudrappa, S.
34. Sachidananda, J
35 Sathyanarayana Setty, B. A.
36 Shivakumar, M. J.
37. Shivalingaiah, H H.
38 Shivanna, B
39 Shivanna, C. S.
40 Shivappa, D. N.
40 *a* Satnyanarayana, L V.
41 Thimmappa Reddy, A.
42. Thippanna, S.
43 Thippe Swamy, P M.
44 Thyagarajan, R.
45 Ujjappa, S.
46 Vaikunta Aithal, P.

SEPTEMBER—1962

1 Channathimmaiah
2 Gururaja Rao, N. V.
3 Gopinath Rao, K S.
4 Jayaraji Gowda
5 Jayanna, S.
6 Kuttappa, C K.
7. Manje Gowda, S B.
8 Muniswamy Gowda, H H.
9 Narasappa, H G.
10 Rajagopal, B. K.
11 Rajanna, S
12 Ramu, V. S
13 Rama Murthy, A M
14 Rajagopal, M. C.
15 Ranganath, S
16 Rama Rao, B. S.
17 Shobhana Murthy, H. P.
18. Thippe Swamy, C G.

MARCH—1963

1 Abadulla, S
2 Aiyappa, K. K
3 Arun Kumar Alva, K.
4 Asoka Srinivasan, G. S.
5 Basappa
6 Bopaiah, M G
7 Chandrappa, C. S.
8 Channappa, S.
9 Govinda Reddy, D.
10 Keshava Murthy, S V.
11 Krishnaswamy, M
12 Kumaraswamy, S.
13 Lakshmana, M
14 Mahadeva Rao, A. R.
15 Mohammed Nisar Ahmed
16. Narayana, N. T.
17 Narayanappa

18 Narayanaswamy, K. N.
19 Ponnappa, P. S.
20 Prabhakar, R.
21 Rabindra, B.
22 Rajanna, B.
23. Rangaswamy, C. R.
24 Ramadas Shetty, K.
25 Sadasivaiah, S. P.
26 Sampath Kumar, B N.
27 Seetharam, A
28. Subramanya, B R.
29. Suryanarayana, D N.
30. Shantha Raj, C.
31. Sharma, K. R.
32 Venugopal Krishnamurthy
33. Visweswara Holla, K.
34 Yathiraja Desikar, H S.

SEPTEMBER—1963

1 M. Achayya
2 Gururaja Rao, H. R.
3. R Halappa
4. Krishnan, S. H
5 Kanakappa, M.
6 Mruthyunjaya Murty, T. H.
7. Raju, S. N
8. Shanthaveera-bhadraiah, S. M.
9 Siddaiah, R.
10. Tajmmul Ahmed

APRIL—1964

1 Aswathanarayana, B. N.
2. Biddappa, C. C.
3. Dasrath Ramaiah, M
4. Devaraj Urs, M. S
5 Divakara Shetty, K
6 Earnest Devaraj
7. Giriyappa, D.
8. Hadi Gafer Hussain
9 Hanumanthe Gowda, K. M.
10. Jageesh Reddy, P. N
11. Jayaram, L. C
12. Jothi, M.
13 Kondaiah, K B.
14 Krishna Prasad, M. N.
15 Krishna Prasad, N K.
16. Kushalappa, K. G.
17 Lakshminarayana Rao
18 Leela Prasad, Y.
19 Mahendrappa, K
20 Masali, B. K
21 Mathew Varghese
22 Narayana, B.
23 Narayana Reddy, M. A.
24 Nasiruddin, G. M
25 Panchaksharaiah, S.
26. Prakash, G S.
27. Ramachandra, K T.
28 Ramaiah, D.
29. Ramesh Melanta, K
30 Rama Rao, R. K.
31 Rudrappa, N.
32 Seshadri, S. N.
33 Shankaracharya, N. B
34 Seshagiri Rao
35 Shiva Kumar, D S.
36. Siddappa, K. S
37. Somashekarappa, G
38. Srinivasa, S R
39. Srinath, D
40 Sunny, A F.
41 Surendranath Pai, H.
42 Syed Siraj Ahmed
43 Thomas, A.
44 Thriruke Gowda, H.
45 Thippe Swamy, M.
46 Umadeva, H.
47 Venkataraman, M.
48. Venkatasiva Reddy, M. S.
49. Venkobachar, V.
50 Vijaya Kumar, N
51 Vijayakumar Hegde, B.
52 Vittal Das, K

SEPTEMBER—1964

1 Balasubramanian, S. K.
2. Prema Sagar Wallia
3. Ramaiah, K.
4. Ramaiah, B S
5. Raghuveer Singh

MARCH—1965

1. Aiyappa, N D
2 Ananda Setty, B.
3 Anantha Narayana, R
4. Appaiah, K M
5 Arockiadas, A.
6 Balasubramanian, R.
7 Basavaraj, H. C.
8 Bhashyam, K. R.
9 Chandrashekaraiah, A. M
10 Chidanandappa, G
11 Devaiah, M C
12. Devaraju, C
13 Gourishankar Krupanidhi, V V.
14 Gurumallappa, T. M.
15. Gurunatha Reddy, M.
16. Harry A
17 Ikramuddin Shaik Imam
18. Jose, A P.
19. Jothe Prakash
20 Khaja Maseed
21. Keshava Murthy, R
22 Krishna, C
23 Krishnan, S.
24 Krishna Reddy, N.
25 Krishnappa Setty, A.
26 Lingaraj Bhupal, S. J.
27 Maheswarappa, R. G
28 Mallaiah, V
29 Mancha Setty, K
30 Megharaja Setty
31 Nagendrappa, S.
32 Nagesha Chandra, B K.
33 Nanjappa, I M
34 Nizamuddin, M
35 Parameswaraiah, B R.
36 Prabhakara, K. N.
37 Prakash Velu, J
38. Punnoose, K P.
39. Raghavendra Rao, K R.
40 Raman D N.
41 Ramappa, M.
42 Ramasubba Reddy
43 Ramesha Rao, S
44. Ramu, S. P
45 Rudrappa, G.
46 Rudrappa, K. M.
47 Raju, G L.
48 Raju, M B.
49 Shankara Setty, V.
50 Shanthaveeraiah, M.
51 Shivanna, D. R
52 Shivashankara, K T
53 Shivaswamy, M.
54 Somashekaraiah, B.
55 Swami Rao, N.
56 Tufail Ahmed Khan
57 Venkatramana Reddy, R.
58. Viswanath, B N.
59 Viswanath Bangera

SEPTEMBER—1965

1 Channe Godwa, S. C.
2 Lakshminarayanappa
3 Cheluvaraju, N P.
4 Joseph, V. T
5 Kariyanna, R.
6 Malleshappa, G
7. Rangaswamy, S R
8 Ravindranath Setty, K.
9 Srinivasa Murthy, H K.
10. Taranath Hegde
11 Viswananda

APRIL—1966

1 Babu, M.
2 Balakrishna Hegde, B.
3 Basanna, M.
4 Basavaraj, K G.
5 Basavaraj, B
6. Basavarajappa, M N
7 Basavaraju, S C
8 Bhadra Reddy, C.
9 Bhoge Gowda, H. C.
10 Channabasappa, P.
11 Channabasappa, R.
12 Cheluvaraju, G
13 Chinnappa, B.
14 Dayanand, C G
15 Dhanyakumar, K N.
16 D'Souza Droston, A L.
17 Ganapathi, B M.
18 Ganesh, T. D
19 Gopalaiah, R
20 Halappa, C. B.
21 Hanumantharaju, P.
22. Hanumantha Reddy, K. R
23 Kantharaju
24 Kenchappa, K.
25 Krishnappa, A. M. (*I Class*)
26 Krishnappa, C M.
27. Krishnappa, K. S
28 Krishnappa, M
29 Krishna Reddy, G. R.
30 Kullayyappa, R
31 Lakshminarasappa, S. L.
32 Madhlekar, M Shet
33 Mahadev, B K.

34. Mahadevappa, N
35. Mahalingappa, M. B.
36 Mallaiah, P S.
37 Mallikarjunaswamy
38. Mari Gowda, C.
39. Md Iqbal, K.
40 Mohd Ziaulla, G
41 Nagaraja, C S.
42. Nagaraje Gowda, A. P
43 Nanjundaiah
44 Narasimhaiah, T L.
45. Narayana Gowda, S N.
46. Parameswara, G S.
47 Bhaneendranath, B. R.
48 Prabhakara, G. S.
49. Prasannakumar, B.
50 Prasannakumar, H. P
51 Rajasekharaiah, N.
52 Ramachandraiah, K. R.
53. Ravany Mallappa Srikantaswamy
54 Sanganna, D H.
55 Shambhu
56. Shankaran, D
57. Shankaranarayana, K S
58. Shiva Murthy, G. S
59 Sridhara Bhandary, P.
60 Shrikar Rai, B.
61. Siddaramappa, R. *(I Class)*
62 Sitharam, T C
63. Shivanandappa, S.
64. Sridharan, S
65. Srinivasaiah, K. A
66. Subramanya, R.
67. Subramanyam, S. P
68. Suryanarayana Reddy, B.
69. Syed Zubair
70. Umesh Mally, B.
71. Veerabhadraiah, V *(I Class)*
72. Veerabhadraiah Gowda, V.
73. Venugopal, B. K.
74. Venugopal, M. K.
75. Viswanath, D. P. *(I Class)*
76. Viswanath, S. R. *(I Class)*

SEPTEMBER—1966

1. Girijendra Rajakumar, R P
2. Jayarama Reddy, E
3. Jayarama, N.
4 Krishnappa, V
5. Malleshappa, G. S.
6. Mahadevappa, K L
7. Narasimhaiah, N
8. Neelakantappa, B S
9. Narasimha Murthy, K. P
10 Parameswarappa, G. S.
11. Ramakrishna Reddy, C L
12. Swamy, B
13. Shivanna, R C.
14 Shivappa, H. T.
15. Shivashankara, Y. T.
16. Veerabhadrappa, S. C,

APRIL—1967

1 Abdul Haseeb
2. Adinarayana Reddy
3 Altaf Hussain
4 Aruna, S R.
5. Ashoka Kumar, T N.
6 Aswathanarayana, K.
7 Aswathanarayana Rao, S R.
8. Bellappa, K M.
9. Bettaswamaiah, M. J.
10 Chaluva Setty, A. C.
11 Chandran, K. R.
12 Chandrasekharan K.
13 Chandrasekharaiah, K. M.
14 Channappa, M
15 Chikkabasappa, H. M.
16. Devaiah, M C.
17 Dharme Gowda, M V.
18 Doddalingappa, K. B. L
19. Gopal, N
20 Gopalakrishna Hebbar, B *(I Class)*
21 Hanumantha Reddy, B T.
22. Jameelur Rahman
23 Jayaram, T G.
24 Jayaramaiah, T. G.
25 Jayamaraiah, H.
26. Jayasheela Hegde, S.
27 Keshava Murthy, K V
28. Krishna Murthy, L K
29. Krishna Prasad, K S
30 Kushalappa, A C
31 Lakshmana Reddy. L.
32. Latheef Ahmed, C
33. Lingadevaru, K V
34 Mahabala Gowda, T.
35. Maheswarappa, K G.
36 Mallikarjuna Setty, J K.
37. Manjunatha Shetty, A.
38 Manoranjan, A.
39 Meeyasahib, K
40 Mudlagiriyappa, N R.
41. Muddappa, K G.
42 Nagaraja, H
43 Nagarajappa, J V
44 Nanjundappa, M
45 Narasimhaiah, P
46 Narayana Bhat, B
47 Narayara Bhat, N.
48 Narayana Reddy, N
49 Prabhakara Rao, H. A.
50 Prabhuswamy, H P.
51 Prasannakumar, S
52 Prasanna, G S
53 Puttaswamy
54 Raghunatha, G
55 Ramuram Shetty, S V.
56. Rangopal, D
57. Rangopal, K V.
58. Rao, M V
59 Rajasekhar, B. N.
60. Ramachandra Reddy, A. G.
61 Ramappa, G.
62. Ravi P C
63. Sadasiva Reddy M.
64. Samba Shiva. B. K.
65. Sampangi Reddy, N.
66. Sathyanarayana Mithyanatha, M *(I Class)*
67 Sabastian, T M.
68 Shiva Kumar, K. G.
69 Shivarudraswamy, S.
70 Siddappa, B.
71 Shivappa, T G
72. Srikantaradhya, R.
73 Sridhara Murthy, G. S.
74. Srinivas, M.
75 Srinivasa Gowda, H. N
76 Sudhakara Shetty, K.
77 Surendra Rao, R.
78 Suryanarayana Reddy, B G.
79 Thippe Swamy
80 Thippeswamy, R C.
81. Trivedi, B. C
82 Vasanthakumar, G
83. Veerabhadraiah, G. P.
84 Veeranna, V S.
85. Venkataswamappa, M.
86 Venugopal, N
87. Viswanatha, N R
88 Viswanathan, K

SEPTEMBER—1967

1 Ahjazul Hussain
2 Basavaraju, H S
3 Basavarajappa, G
4 Chowdaiah, B
5. Ganga Shetty, R
6 Ganga Reddy, G
7 Gopala Reddy, S P.
8 Hanumanthappa, M. E.
9 Mugammil Rahman Ansari
10 Mahadevaiah, G. S
11. Narayana Reddy, D.
12 Reginald Gonsalves
13 Ramu, P. M.
14. Rajagopal, H B.
15 Selvarathanam, E.
16 Sundara Rao, C
17 Shekarappa, H G
18 Sivabasavaiah, R
19. Shrikanth Rao, K
20 Umesh, B. C.
21 Venkata Subba Reddy, B S

APRIL—1968

1 Achappa, M G
2. Aiyappa, P S
3. Amaranath, D M
4. Baburaya Nayak, N.
5. Balakrishna Rai, K
6 Balakrishna Shetty, K.
7. Basavaraju, B
8 Chandrabhanu Singh, B. R
9. Chandrappa, T R.
10 Chandre Gowder. P. A.
11. Deshapande, V P
12 Deve Gowder, B S
13 Dwarakanatha, N.
14 Gajanan, G N.
15. Ganapathi, T. K.
16 Gangadharan, G.

17. George Thomas
18. Gopala Gowda, H. S.
19. Gopala Reddy, G. R.
20. Gopala Reddy, T.
21. Govinda
22. Gubbaiah
23. Gundu Rao, A. V.
24 Gurusidhana Gowda, T.
25. Gurusiddaradhya, H. S.
26. Halappa, H. G.
27. Hanumantha Rao, D. S.
28. Hemagiriyappa, D. G.
29. Hiriyannaiah, G.
30. Honnappa, T.
31. Janakiram, B. K.
32. Janardhana Rai, K.
33. Jayaramaiah, M.
34. Jayarama Reddy, S. V.
35. Kempe Gowda, B.
36. Kersi N Villimoria (*I Class*)
37. Krishnaiah, B. N.
38. Krishnoji Rao, P. S.
39. Krishna Murthy, R. K.
40. Krishnappa, A.
41. Krishnappa, M
42. Krishnaswamy Iyenger, B. G.
43. Lakshmana Rao, L.
44. Lakshmappa, K. B.
45 Lokamanya, D. S.
46 Malle Gowda, K. H.
47. Manjunatha, A.
48. Manohar S. Nayek (*I Class*)
49. Mohamed Ibrahim, B.
50. Muniyappa, G.
51. Muniyappa, V.
52. Murthy, S. R S
53. Musthak Ali, T. M.
54. Nagaraj, G.
55 Nagaraj, K. U.
56. Nagarajappa, D. R.
57. Nagaraja Rao, N. P.
58. Naik, C V.
59. Nandi Gowda, N. P.
60 Nanje Gowda, D.
61. Nanjundappa, D.
62 Palakshappa, G.
63. Parameswaran, K S. (*I Class*)
64. Poovaiah, M D.
65. Prakashchandra Hegde, K.
66. Puttaswamy, N
67. Raghunatha Reddy, D. N.
68 Rajendra Padival, B.
69. Ramachandra, M. A.
70. Ramakrishna Setty, C. R.
71. Rame Gowda, G.
72. Rathnaiah, M.
73. Rathnakar, M.
74. Rathnakar Shetty, K.
75. Remanna, N. K.
76. Sadananda Rao, K.
77. Sadashivaiah, K. N.
78. Saeiquallakhan
79. Samiullah, R.
80. Sathyanarayana Somayaji, K.
81. Shailendranath, K.
82. Shankaranand, K.
83 Shivalingappa, C. V.
84 Shivappa, B.
85. Shivana Gowda, B. S.
86 Shivarudrappa, A. P.
87 Shivashankar, B. S.
88 Siddamallaiah, H. S.
89. Siddaramaiah, B. S
90. Sreekanteswara Das, K. G.
91. Srinivasachari, V.
92 Srinivasulu, G.
93 Srikantaiah, B. V.
94 Srinivasa, H. P. (*I Class*)
95. Srinivasa Reddy, V.
96. Sundraswamy, B.
97. Suryakantha, R.
98. Syed Mahabood Peeran
99. Thimme Gowda, S.
100. Thippe Swamy, K. C.
101. Thomaes Jupry Rego (*I Class*)
102 Ujjinaiah, V. S.
103. Umapathi, P. N.
104 Venugopal
105 Venkatachalaiah, A. V.
106 Virupaksha, M.
107. Varadaraja, H.
108 Yellapa, E.

SEPTEMBER—1968

1. Anne Gowda, A.
2. Badappa, K.
3 Balaji Rao, A
4. Basavarajappa, P. K.
5. Basava Iyer, N
6 Basavanthappa, K.
7. Charles I Fernandes
8 Chythanya Kumar, N B.
9. Channe Gowder, D. S.
10 Devaraj, K G.
11 Gangadhar Tilak, R.
12. Ganganna, M
13. Ganga Reddy, M.
14. Govindarajulu, M.
15. Ganapathy, K. G.
16 . Hosurappa, M. H.
16 *a*. Halappa, G.
17 Hanumantha Raju, B. L.
18. Jayappa, C. C.
19 Jagadeesh, H M.
20. Jahagirdar, H. M.
21. Jayaram, G.
22. Jayashankarappa, H. N.
23. Karibasappa, J. K.
24. Kariyanna
25 Kappanna, A N
26 Karmic, K. S
27 Krishna Murthy, B
28. Muniyappa, T. V.
29. Manje Gowda, A. S.
30. Nanjaiah, J.
31. Narayanappa, J. T.
32. Nanjappa, P. S.
33 Narasimha Murthy, B. S.
34. Naraismha Murthy, N. K.
35. Narayana, C. K.
36. Prasanna Kumar, N.
37. Patalappa
38 Rame Gowda, H.
39. Rache Gowda
40. Raghava, C M.
41 Rajanna, T. V.
42. Ramachandrappa, G. V.
43 Ramadas Shetty, B.
44 Ramananda Rao, V.
45 Ranganathappa
46 Shivanna, S.
47. Syed Ibrahim
48. Shivaswamy
49 Swamy, M.
50 Sanjeevaiah, S. G.
51 Shashidhara, K. M.
52 Subbanna Bhat, A.
53. Shankarappa, B L.
54 Srinivasulu, A.
55. Suresh, N L.
56. Thimmappa, H.
57. Thimmaiah, T.
58. Umamaheswara, A. C.
59 Venkataramanaiah, S. L.
60 Venkatesh, S

APRIL—1969

1. Abraham, K.
2. Ayyappa, B G.
3. Amruth Sudhakar, M.
4. Ananthaiah, H. N.
5. Ashoka, B. N.
6. Ashok Kumar, G. T.
7. Balakrishna Bhat, A.
8. Balasubramanya, R H. (*I Class*)
9. Bheemaiah, M M.
10. Chamaraj
11. Chandraiah, N.
12. Chandrappa, C. T.
13. Chandrappa, H. M. (*I Class*)
14. Chandrasekhara, K. S. (*I Class*)
15 Chandrasekharaiah, D. B.
16. Channappa Gowda, B. A.
17. Chikka Kempe Gowda
18 Chinnappa, M. A. (*I Class*)
19 Chinnaswamaiah, B.
20. Chittaranjan Shetty, K.
21. Chittarajan, M.
22. Devaiah, M. A. (*I Class*)
23. Deviprasad Shetty, M.
24. Eswarappa
25. Gavi Gowda (*I Class*)
26. Gopala Setty, Y. N.
27. Govindappa, K.
28. Govinda Reddy, S A.
29. Hanumanthappa, H. S.
30. Hareesh, B
31. Issac Nathaniel, S.
32. Jayaram, N. S.
33. John Abraham
34. Kalappa, N. P.
35. Kariyappa, P. T.

(*I Class*)
36. Kashi, A. K.
37. Kempaiah, M.
38. Krishnappa, D
39. Krishnaiah, N
40. Lakshminarasaiah, N.
41 Lakshminarayana Rao, N. A.
42. Linge Gowda, B M.
43. Loka Prakash, G. S.
44. Lokeswarachari, H. M. (*I Class*)
45. Mahadeva Gowda, M.
46. Mallikarjunaiah, R R.
47. Manche Gowder, H. M
48. Mallikarjunaiah, Y
49. Manishankar, N.
50 Manjunatha Rao, K. N.
51. Karisiddaiah, M.
52. Mohamed Khasim
53. Mohanadas Shetty, K.
54. Mruthyunjaya (*I Class*)
55. Mudveerappa, K. (*I Class*)
56 Muni Reedy, A.
57. Muniswamaiah, H. N
58 Muthanna, K. M.
59 Mylari Lingaiah, H. C.
60 Nagappa, D.
61 Nagaraja, A S
62 Nagaraja, H. K
63. Narayana Gowda, J. V.
64. Narayana Reddy, A.
65 Nataraja, D. C
66 Ningappa, N. S. (*I Class*)
67 Paramasivaiah, N. T. (*I Class*)
68. Parthasarathy, T V.
69 Poovaiah, B K.
70 Prabha Shankar, M. R.
71. Prahlad, M. B.
72. Praksh, S.
73. Prasad, K. N.
74. Prasad, T. G
75 Premananda Shetty, V H.
76. Purushothama, C T. (*I Class*)
77. Puttaswamy, S.
78 Radhakrishna Shetty, A.
79. Rajappa, S
80. Raghavendra Rao, H. N
81. Ramachandra, M
81 *a* Rajappa, S.
82. Ramachandraiah, B.
83. Ramachandra Reddy, D.
84. Ramadasappa, O S.
85. Ramaiah, C K
86. Ramaiah, H.
87. Ramalinge Gowda, S. K (*I Class*)
88. Ramanna Gowda, P.
89. Rama Sastry, K. V.
90. Ramaswamy Reddy
91 Ranganatha, T.
92. Ranganatha Rao, M K
93 Ranganna, T.
94. Rangappa, L.
95. Rathnaiah, K. M.
96. Ravindra Aithal, K.
97 Revanna, G. H.
98 Rudra Muniyappa, B. M.
99. Sadashivaiah, A. S.
100 Sadashiva Murthy, D. M.
101 Sampath Kumar, K. J.
102 Sannarangappa, O.
103 Santhaveerappa, J.
104 Sanaulla, S J
105 Shanthakumar, B
106. Shanthaprasad Alva, A.
107 Shivalingappa, B.
108 Shivaprakash, S. M.
109 Shivarama Reddy, M.
110 Shivaswamy, N. K.
111. Shivaswamy, Y. N
112. Siddaramanna, A. V.
113 Siddaramaiah, A. L.
114. Siddarame Gowda, T. K. (*I Class*)
115. Silpachary, B.
116 Shivashankar, Y.
117. Somashekara, Y S.
118 Srikante Gowda, A. N.
119. Sreeramulu Setty, G.
120. Srinivasa Babu, M N. (*I Class*)
121. Srinivasappa, N.
122 Subbaiah, K M (*I Class*)
123 Subba Rao, T. N.
124 Subhashchandra Bose, G. R.
125 Subramanya, H. L.
126. Subramanya Rao, V.
127 Syed Ataulla
128 Syed Meer
129 Thimmappa, B. M.
130 Thimmana Reddy, S K.
131 Umamaheshwar, B C
132. Umeshachandra Banarji
133 Umesh Rao, A.
134 Varadaraja, M. K.
135 Vamana Murthy, K S.
136. Venkataramana Naidu, R.
137 Venkataramana Reddy, A.
138 Venkatarathnam, G
139 Venkatarayappa, T.
140 Venkateshalu, G.
141 Venkateswara Rao, A S. (*I Class*)
142 Venugopal, B N
143. Victor Lobo
144 Virupakshappa, H.
145 Visweswara Gowda, B. L. (*I Class*)
146 Vamana Murthy, K. S.
147 Yogesh Herle, P

SEPTEMBER—1969

1. Abdul Khader, S
2. Aiyanna, A K
3 Chandrasekhar, C P.
4 Chidananda Reddy, S. B
5 Chandra Mohan, K C.
6. Chandrasekhara Shetty, K.
7. Eswara Rao, B
8. Gurumurthy, J V
9 Hombaiah, H. M.
10. Javare Gowda, K.
11. Katah Saheb, K.
12 Kallappa, H.
13 Kenchappa, Y.
14 Krishnappa, V C.
15 Manjunath, H. S.
16 Made Gowda, N. N.
17 Mahadevaiah, S. T.
18 Nagaraja, K.
19 Nagarajappa
20 Nanjaiah, P. N.
21 Nanjundaswamy, K. M
22. Puttaswamy, K. M.
23 Ramaswamy, K. B.
24 Range Gowda, K.
25 Shivakumar, G M
26 Shivashankarappa
27 Shankaralingu, L
28 Shiva Nagendra, K. G.
29 Shivananje Gowda, B. N.
30. Shiva Prasad, M
31. Shivaramu, K.
32 Venkataramanappa, K.
33 Venkatapathy, M. R.
34 Venkatarangaiah, V.
35 Viswanath, G

APRIL—1970

1 Bheemana Reddy, B. L.
2 Chandrasekhara Reddy, A.
3 Chandrasekhar, B (*I Class*)
4. Chikkamudde Gowda, C.
5. Dasharathe Gowda, B. A.
6 Devaiah, M C.
7 Devaiah, D C
8 Eswara Rao, S
9 Gunasekhara Reddy, T.
10 Hari Prasad, N
10 *a* Iyyanna, J. S.
11 Jayakumar, V. C.
12 Jayanna, K. P.
13 Jayaprakash, S. J.
14 Jinendra Prasad, K.
15 Jai Nanjunda Reddy
16 Kailas, J D.
17 Krishna Murthy, M
18 Krishna Murthy, P
19 Krishnappa, N M. (*I Class*)
20. Krishne Gowda, M
21 Kumar, P R
22 Madaiah, C K
23 Madappa, H S
24 Mahadevaiah, L
25. Mahadevappa, M. N.
26 Nagaraju, M S.
27 Nanjunda Gowda, V.
28 Natesh, B R.
29 Ponnappa, B P
30 Prahallada, M. L.
31. Prasanna Kumar
32 Rajendraprasad Rai, T M.
33 Ramachandra Reddy, Y.
34 Rame Gowda, B. M.
35 Range Gowda, N N.
36 Revsnasiddappa, K. V (*I Class*)
37 Rudraradhya, M (*I Class*)
38 Sanjeevarayappa

39 Sannaranga
40 Shekharaiah, G. S.
41 Shivaprasad, M. V.
42. Siddaramaiah, B. G.
43. Siddaramaiah, M.
44 Somanatha Babu, S.
45 Sreenathan, D. S.
46. Srinivasaiah, S. M.
47 Srinivasa Murthy, A. G.
48 Subbe Gowda, M G.
49 Sheelakeerthi, M
50 Suryanarayana, G.
51 Sridhara Murthy, G N.
52 Shivalingappa, H. P.
53 Shiva Murtny, G.
54 Thimmaiah, V.
55 Venkata Reddy, S
56. Venkatesha Murthy, K. N.
57. Vijayakumar Reddy, A V. (*I Class*)
58. Virupaksha Gowda
59 Vittala Setty, J. N.

SEPTEMBER—1970

1. Balakrishna, B. P.
2 Chandrasekhar, K.
3. Govindaiah, H. C
4. Hiranneiah, D.
5 Hanumarangaiah
6. Jayadeva, G. V.
7 Jagadeesha, N. B.
8 Janardhan, M. S.
9 Krishna, V L.
10. Kalachary, U.
11. Kempe Gowda, T H.
12 Krishnappa Gowda, T.
13 Madhukar, A
14 Mallikarjuna Swamy, M. C.
15 Nanje Gowda
16 Nanje Gowda, M. R.
17 Nanjundappa, S
18 Narayanaswamy, B. A
19 Ningaiah, N.
20 Ravindranath, K. H
21. Shivanna, C
22 Sundar Raj, A. R
23 Srinath Reddy, C. S
24. Vijayarudraswamy, H. S

APRIL—1971

1. Arifulla Baig
2 Elie Augustine Kanku
3 Keshava Murthy
4 Krishna Murthy, S.
5 Muddaiah, M.
6 Narayana Reddy, S.
7. Obaiah, A.
8 Parasuram, H. T.
9 Shivaswamy, T.
10. Srinivasaiah, K. A.

SEPTEMBER—1971

1 Anantha Ramu, B M.
2 Balakrishha, K
3. Jagadeesh, T M.
4 Krishnappa, A R.
5 Manjunath, G.
6 Nagaraju, T.
7. Ramachandre Gowda, A.
8 Shankarappa, G. N.
9 Subbe Gowda, N. M.
10. Yedurappa

NEW SCHEME

1971

1. Ananthapadmanabha Somayaji
2. Anjaneyalu, S
3 Badrinath
4. Balasunlramurthy, C.
5 Baskara Naidu, B. N.
6 Basavaraju, V.
7 Basavaraju, M. M.
8 Basheer Ahmed
9 Bylaiah
10. Challaiah
11 Chandrakeerthi
12 Chandrasekhara Murthy, N.
13 Channanjappa, T.
14 Dayakar, D C.
15 Devaraju, N.
16 Diwakara, B G.
17. Durga Prasad, K
18 Ganapathy, K. M.
19. Garudaraj, D.
20 Guruswamy, K. P
21. Ghorpade, K. D.
22 Habeebulla Khan
23 Hiremath, B. N.
24 Honne Gowda, T
25 Horce H Machado
26 Jagannatha Reddy, B. T
27 Karki, K B.
28 Krishnaiah Setty, P. S
29 Krishnappa, K
30. Kumar, V L.
31 Kumaraswamy, T S.
32. Krishna Prasad
33. Krishna Kothaya
34. Krishne Gowda, K. T
35. Lobo, A M.
36. Mir Amjad Ali
37. Mallaraj Urs.
38 Mallikarjuna-swamy, K R.
39 Mohan, B R
40. Munikrishnappa, B. T
41 Mukundan, P
42 Nagaraj, A.
43 Nagaraj, C S
44 Nagaraj, V.
45 Nagarajaiah, M. C
46 Nagarajan, P.
47 Narasimha Murthy, K.
48 Narayana Reddy, J. R.
49 Nazir Ahmed Khan, A.
50 Nagananda, R
51. Neelakanta, P. R.
52 Obanna, M
53 Parameswara Aithal, K
54. Paramanandan, M.
55 Prasanna Kumar, G. S.
56 Padma Raju, R
57 Prabhakar, J
58 Pradeep Kumar, C S.
59 Prakash, T C.
60. Rangaswamy Setty, H M.
61. Rachaiah, P.
62 Rajashekarappa, C.
63 Rajendra, B
64 Rajagopal, K.
65 Range Gowda, M.
66 Rama Murthy, H. S.
67 Ramachandra, H S
68 Reddappa Reddy
69 Sarat Sadanand
70. Sathyavijaya Simha, K
71 Shanmukha, N.
72 Shivashankar, N V.
73 Shankar Kumar, B.
74 Shivachandra, J.
75 Shankara Reddy, K V.
76 Sharma, V V.
77. Sreerama Reddy, B
78 Srinivasa, V.
79 Sridhar, M.P
80 Srinivasa Raju, R.
81 Subramanya, K A
82 Sundaresh, H N
83 Surendra, B S
84 Suresh, K V
85 Suresh, P
86 Suresh, S V.
87 Swaminathan, G
88 Syed Shahabuddin
89 Syed Anwarulla, M.
90 Vedantham, S S
91 Venkataramana Reddy, M.
92. Venkateshulu, K
93 Venkatachalapathy Shetty, K.
94 Venugopal, R
95 Venugopal Reddy, L
96 Veerabhadraiah, H. M
97 Venkatesh, K
98 Venkataramana, K.

1971

1 Abdul Khader, M.
2 Amarnath Rao, B. P
3 Abraham Mathew
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